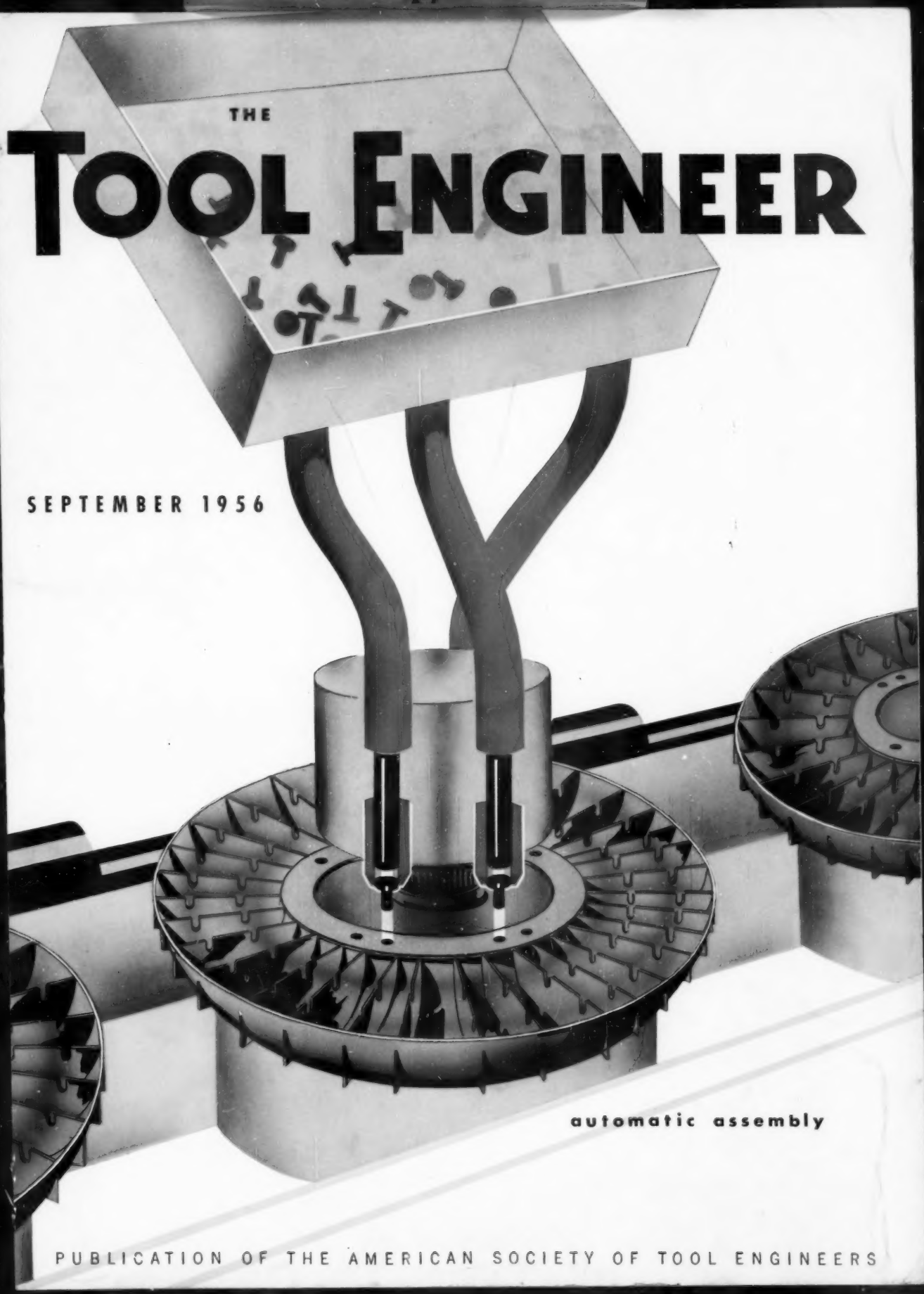
THE

TOOL ENGINEER

SEPTEMBER 1956



automatic assembly

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

Heald VERSATILITY in action

How a STANDARD* Plain Internal Grinder SAVED IDLE MACHINE TIME

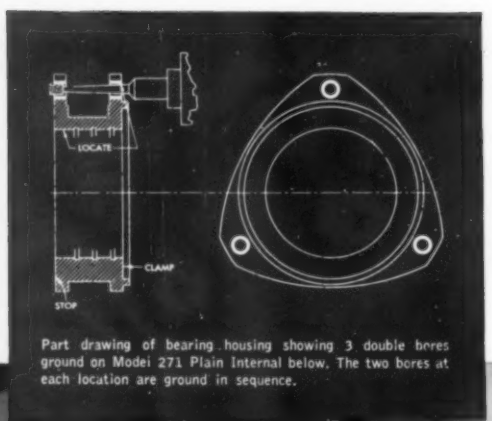
Heald Model 271 does a month's production ALL IN A DAY'S WORK . . . and can do many other jobs in its "spare time"

THE race is not always to the swift. For example: An aircraft manufacturer requested a quotation on a Model 271 Size-Matic for grinding three double bores in a bearing housing. Production requirements — 25 parts per month. A high-speed Size-Matic would do the whole job in less than a day — and be idle the rest of the time. So Heald engineers recommended a Model 271 Plain Internal instead. This *semi-automatic* machine could still do the whole month's production in one day — yet because of its inherent *versatility*, the standard Plain machine could be used for many other internal grinding jobs in its "spare time".

This solution to the problem not only saved on the initial investment, but avoided idle machine time and contributed to greater productivity and lower costs. The 271 Plain Internal, and the job for which it was ordered, are shown below. For the *best answer* to any precision finishing problem . . .

It PAYS to come to Heald

**Send for Bulletin 2-2569-I, Issue I.*



Part drawing of bearing housing showing 3 double bores ground on Model 271 Plain Internal below. The two bores at each location are ground in sequence.

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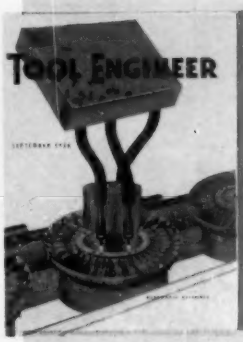

COVER: Automatic assembly is becoming a reality by inspired engineering in typically American fashion. In the process depicted, rivets are inserted in a torus assembly at Detroit Transmission Div., GM. This and other developments are assessed in a special report beginning on page 113.

The Tool Engineer

Volume XXXVII, No. 3 September 1956

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THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and the *Industrial Arts Index*

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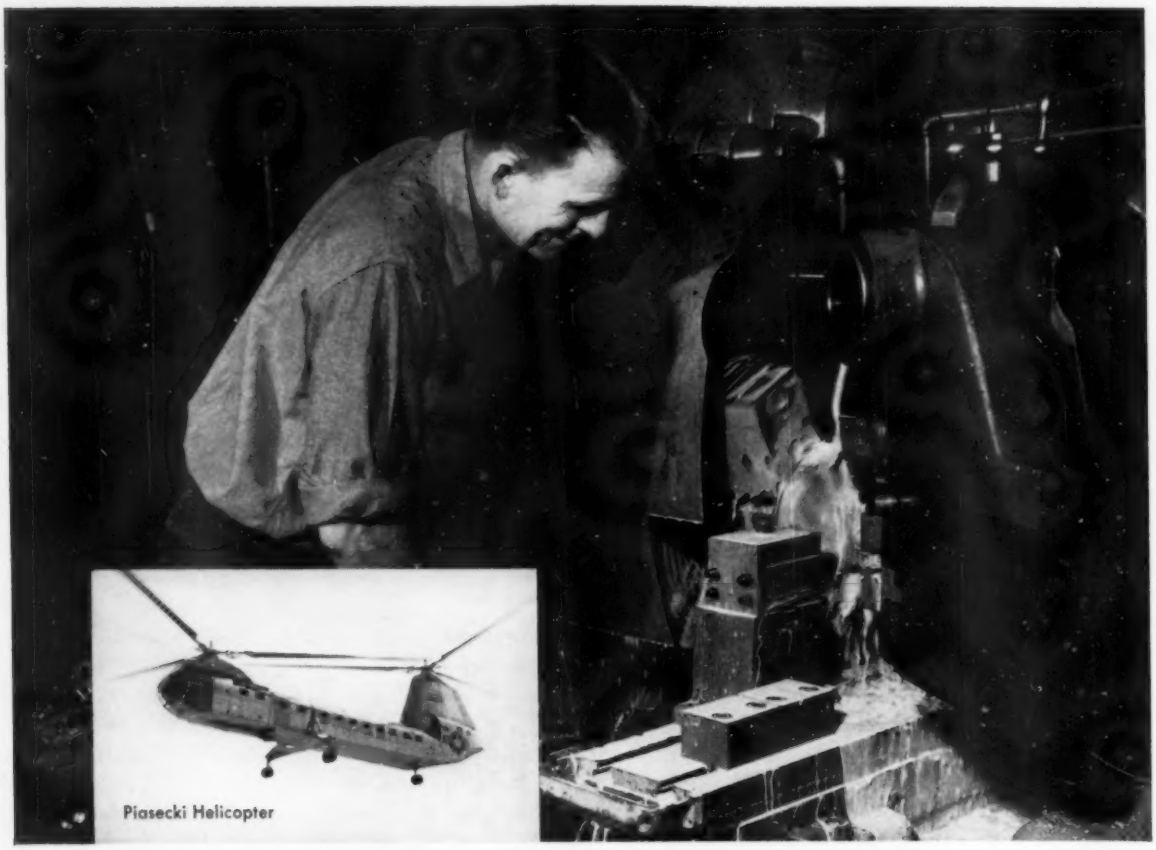

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The Tool Engineer

Gadgets

Modern industrial progress is generally thought of in terms of bigger and better machine tools, increased automaticity and geometrically increasing production rates. This is an accurate picture so far as trends in mass production manufacturing are concerned. It reflects the continuous evolution of tool engineering concepts.

There is another aspect of tool engineering, however, which also has a considerable cumulative effect on productivity, although the results are not nearly as spectacular. Many production problems are solved by the ingenious adaptation of existing machines. Special fixtures may improve productivity, quality, and operator safety. Other improvements may substantially reduce maintenance costs. Development of short-cut methods of machining or special work holders may cut die making time drastically on specific jobs.

This kind of tool engineering can be defined as getting the most out of what you've got. While most tool engineers would like to take advantage of the latest available machines, tools and production techniques, economic factors often dictate the use of existing machines and equipment.

Evidence that many tool engineers are getting the most out of what they have to work with is continuously being furnished by contributions to our Gadgets Department. In this issue we're announcing a Gadgets Contest, which has the purpose of encouraging tool engineers to share their cost and time-saving devices and methods with other tool engineers. We're hoping for many entries, including yours.

Theodore W Black

ASSISTANT EDITOR

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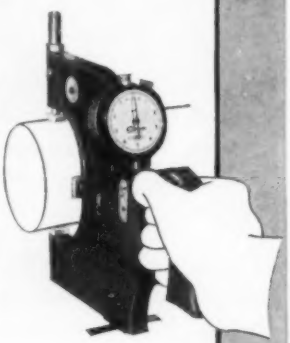

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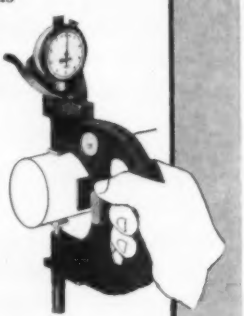

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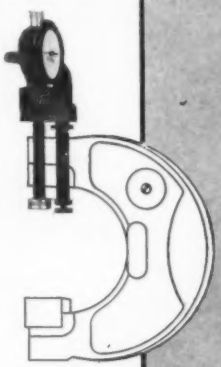

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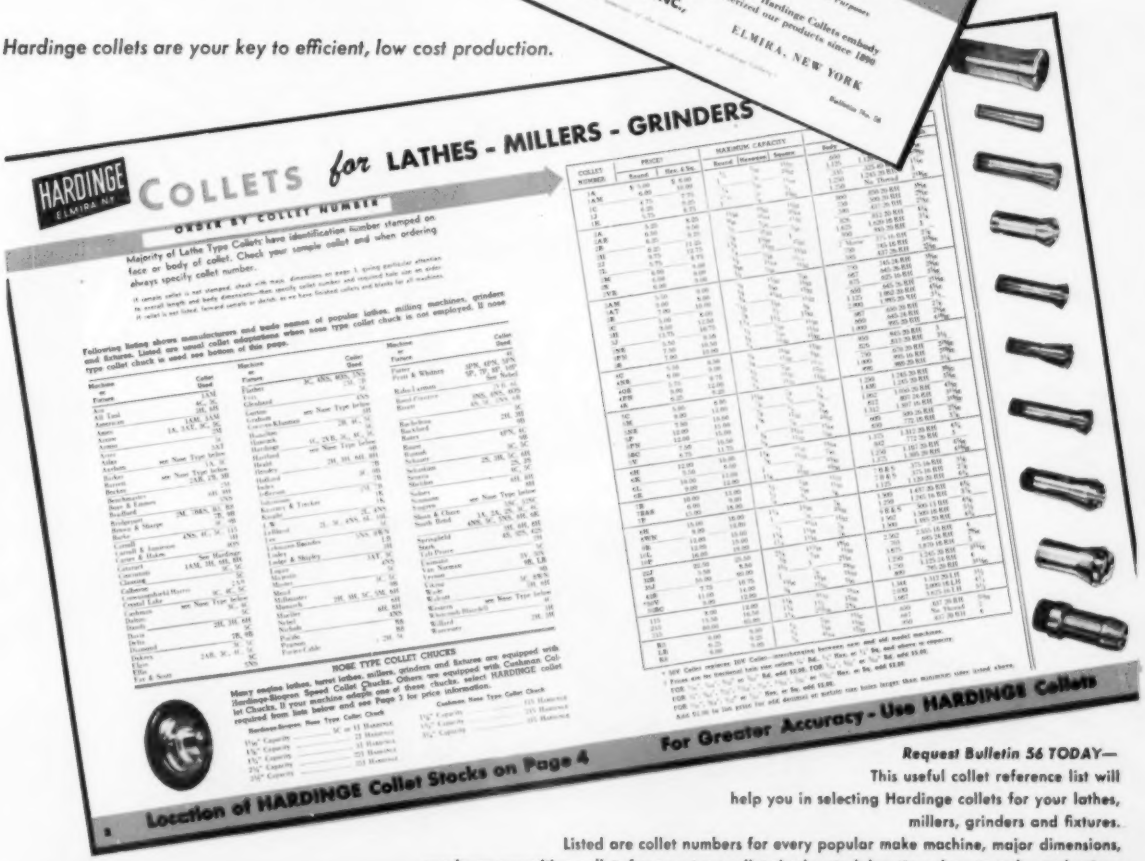
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NOSE TYPE COLLET CHUCKS
Location of HARDINGE Collet Stocks on Page 4
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Listed are collet numbers for every popular make machine, major dimensions, maximum capacities, collets for nose type collet chucks, stock locations, how to order and prices.

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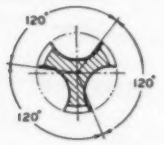

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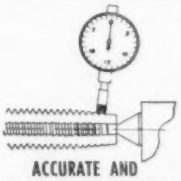

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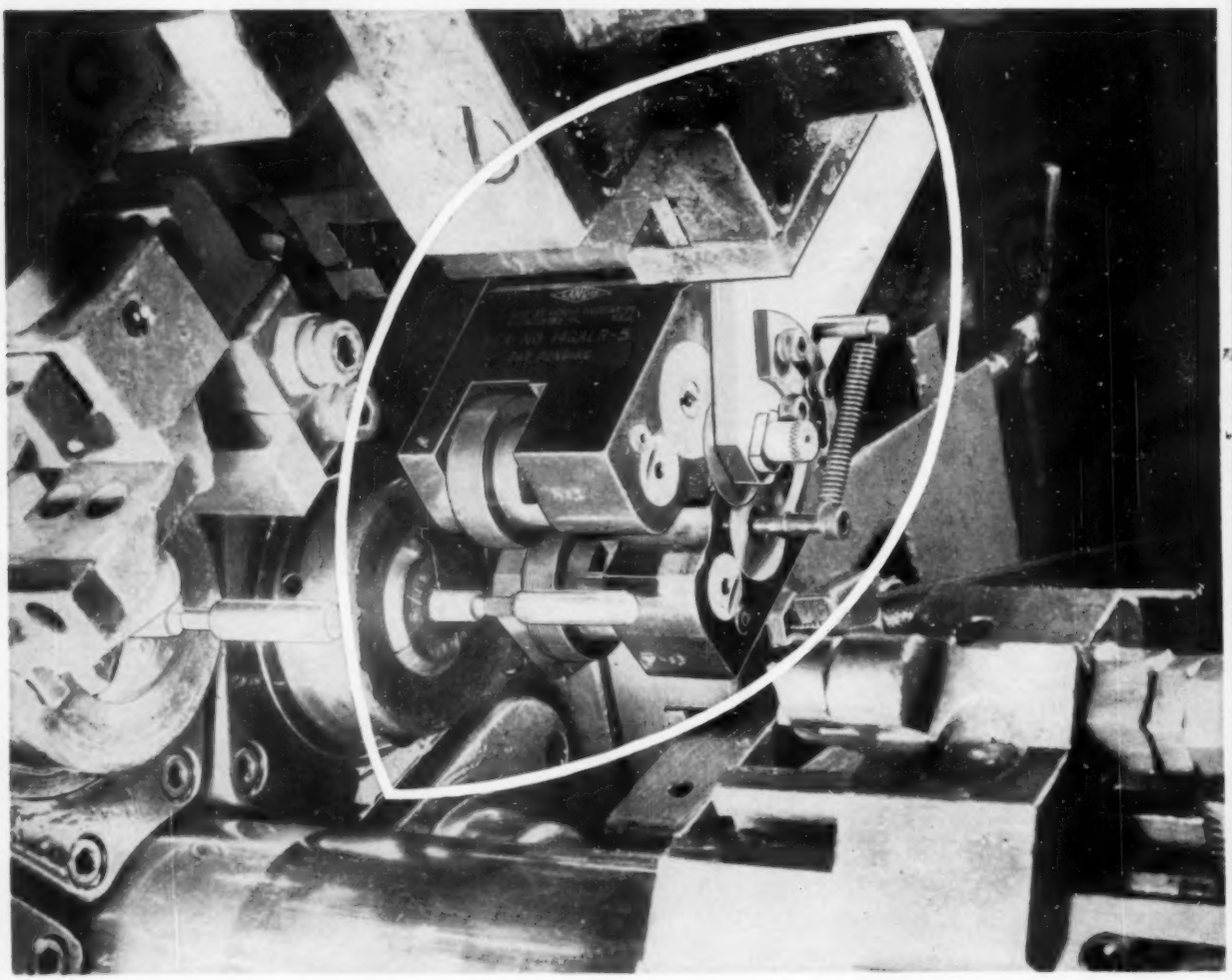

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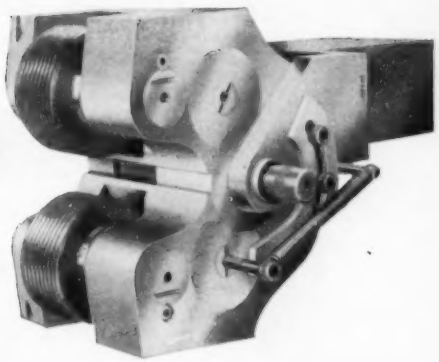

The economy of LANDIS Thread Rolling Attachments due to long roll life is being demonstrated in the production of studs at the M & S Morenci Corporation in Morenci, Michigan.

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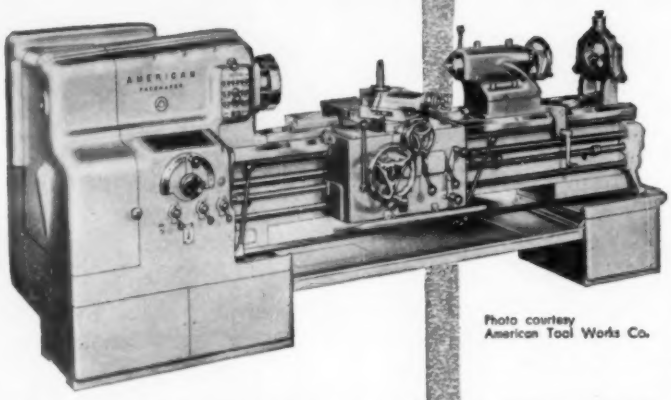

Photo courtesy
American Tool Works Co.

Here is the new 16" DeLuxe Model "AMERICAN" Pacemaker Lathe. This new design places particular emphasis upon the factors of power, stamina, dependability, precision, accuracy and ease of operation required for both production and tool room service. For complete data write for Bulletin No. 116, The American Tool Works Co., Cincinnati 2, Ohio.

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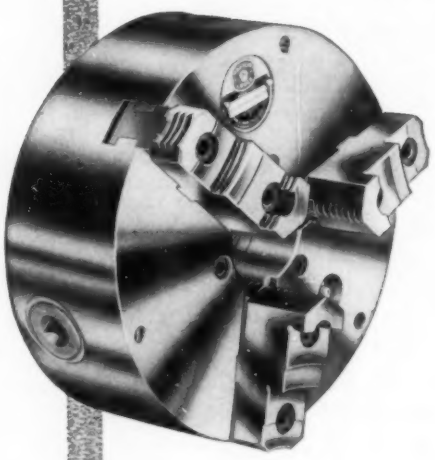

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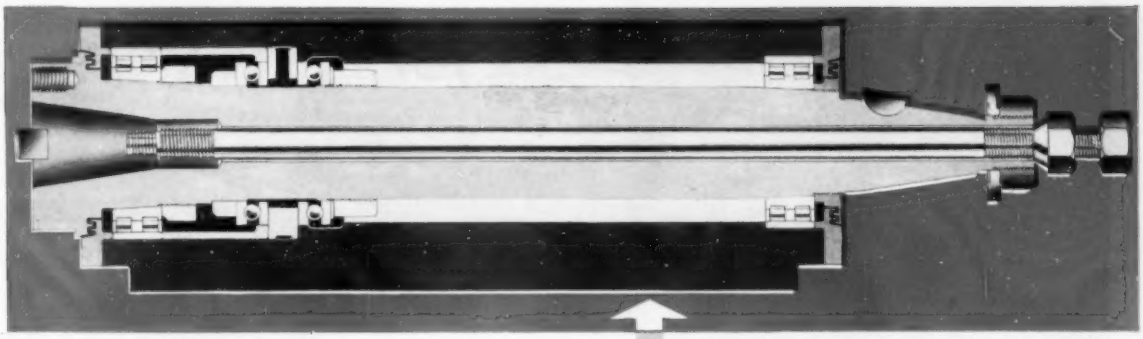

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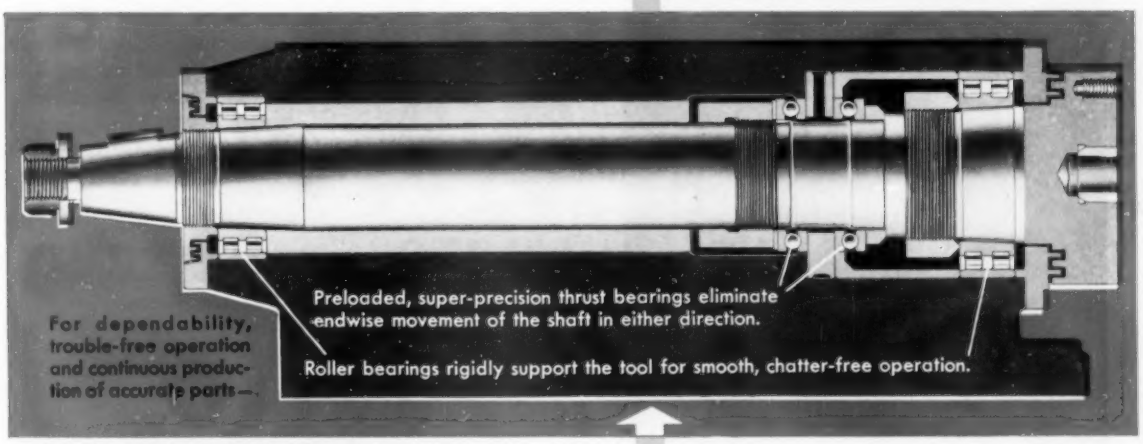
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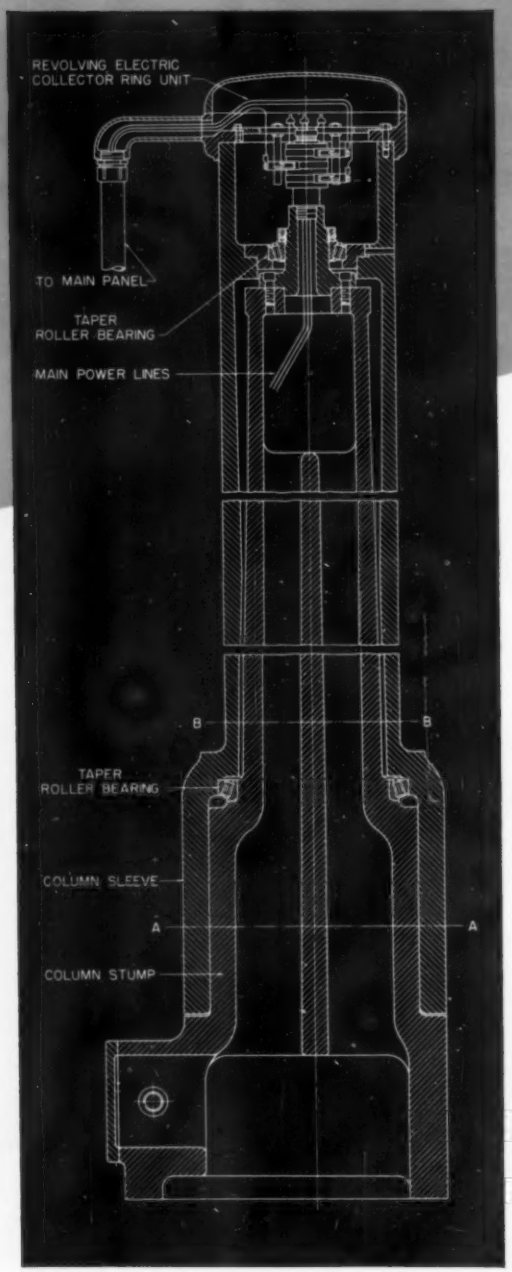

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The new "TIMKEN" mounting of the column and sleeve on the new model 32-speed Hole Wizard Radial has hit the "jack-pot" for rigidity. It's the stiffest, most resistant column unit we've ever known.

Under drilling tests up to 30 horse power deflection has been cut in half over former models. It's truly a marvel of rigidity.

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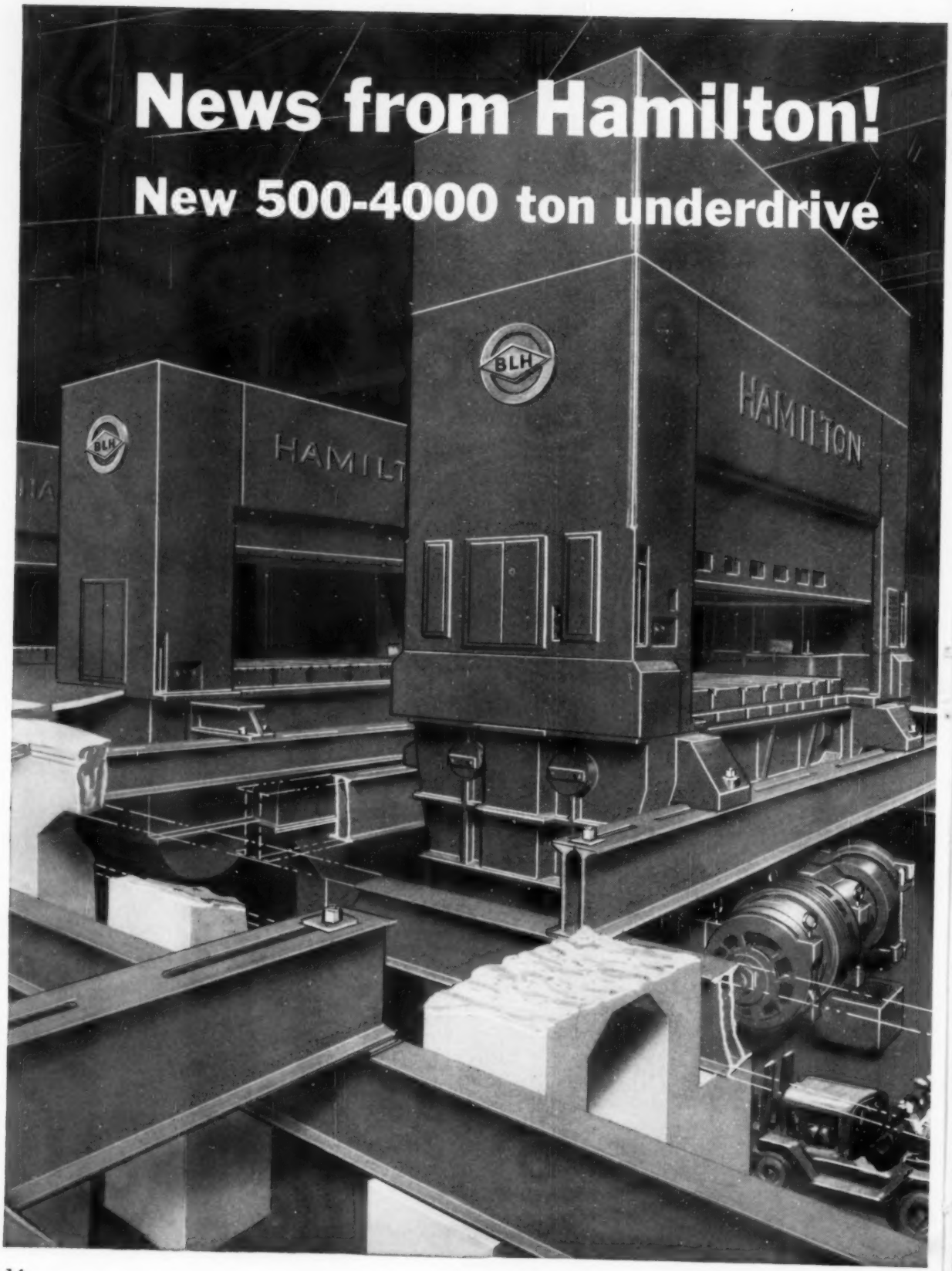
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• *Operating mechanism in the press bed* simplifies inspection and maintenance . . . out of the way of production.

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• *Swivel arrangement of counterbalance cylinders* insures proper alignment when gibs are adjusted.

• *Safety die blocks and die lights* add effective operating safeguards.

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- Double acting presses
- Triple acting presses

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Write for information and prices on micro, standard and tungsten carbide drill jig bushings, dowel pins, chamfer micrometer gages and portable bench centers.

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- Acme Pins are case hardened to 60-62 Rockwell "C" scale and core hardened to 36-38
- Acme Pins will break before bending or mushrooming

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Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

TWO "FIRSTS" STRETCH AUTOMATIC TURRET LATHE CAPACITY

Octagonal Turret with JETracer Offers More Work Per Chucking

By taking advantage of two "firsts" in automatic turret lathe accessories, the Edward Valve Division of Rockwell Mfg. Co., East Chicago, Indiana, has increased production of 1½" steel Univalve bodies.

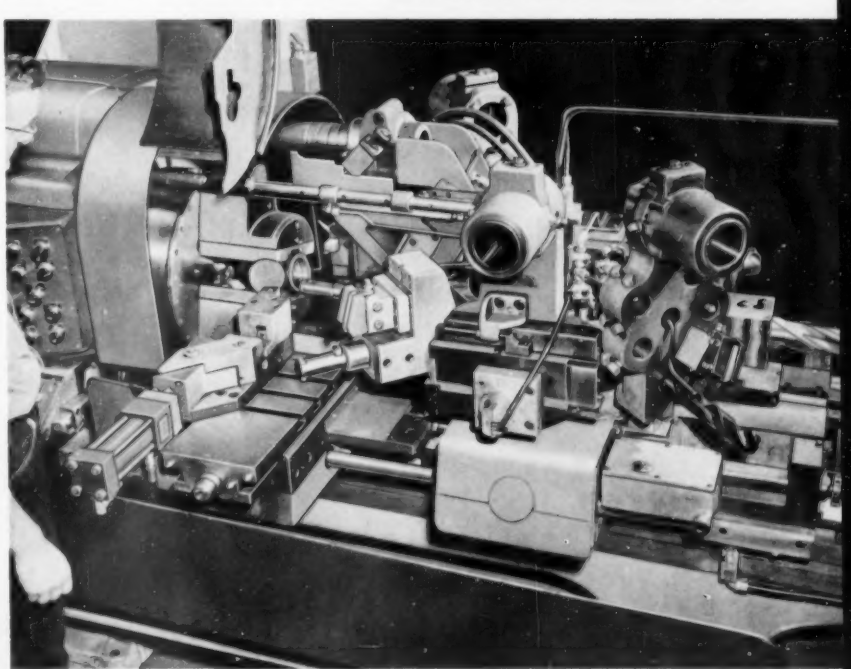
A new MASTERLINE 2F Fastermatic is used. Equipped with an 8-sided turret and a turret-mounted JETracer, a maximum number of surfaces are machined per chucking. Setup is especially fast and easy. The Fastermatic's toggle switch setup control panel is used to preselect all important machine functions, including low spindle speeds for drilling, forming and threading and high speeds for other operations.

The workpieces are held in an 18" 2-jaw hydraulic operated chuck. Automatic positioning at the end of each cycle speeds loading and unloading. After the automatic cycle is started, hexagon turret tools drill, turn, face, form, relieve, chamfer, bore and thread, in addition to facing and chamfering performed from the two cross slides. The turret-mounted JETracer operates within the cycle to maintain high accuracy on the difficult internal machining operations.

The first operation is shown. The part is machined from the solid in 8.5 minutes floor-to-floor time. After the lot is completed, tools are adjusted on 4 hexagon turret stations and the part is completed, including generating the seat angle with the JETracer, in 2.8 minutes floor-to-floor.

Greater accuracy, finer finish and consistent quality are provided by completing maximum number of surfaces in a single chucking and using the JETracer.

Workpiece, showing multiple diameters accurately machined in two fast automatic operations.



Close-up of tooling. Note octagon turret mounting the JETracer unit, which is actuated by second overhead stop bar eliminating interference with overhead-piloted turret tools.

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

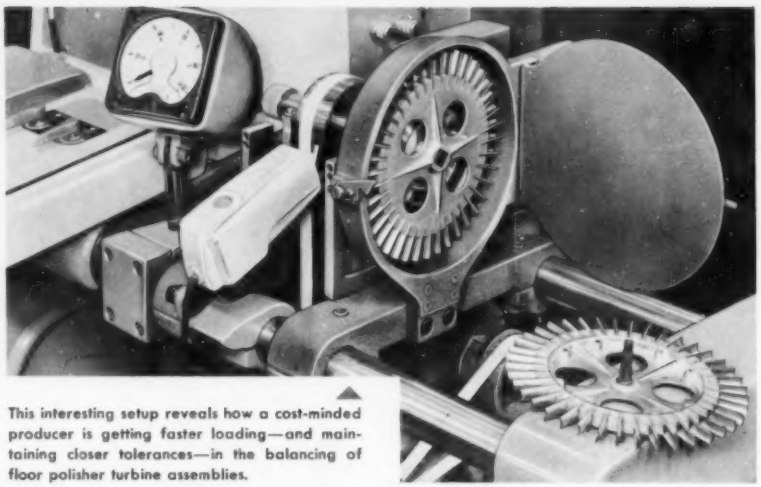
BALANCING IN OVERHANG SIMPLIFIES HANDLING

Gisholt 1S with Special Arbor Makes Impeller Balancing Precision, High-Speed Operation

With this arrangement, the producer is balancing floor polisher turbine assemblies outside the work supports eliminating the work of belt-shifting and arbor-handling.

The machine used is the Gisholt Type 1S balancer, equipped with a special arbor which is not removed from the work supports. A hinged shroud reduces air-turbulence and protects the operator. Because the part has large diameter compared to width, only single-plane force unbalance is measured.

The Direct Reading Amount Meter is calibrated to make one unit equal 1/32" drill depth of a 3/16" drill at the correction radius. The operator simply looks at the meter, marks the angle, removes the part and corrects it on a nearby drill press using a 1/32" depth scale to speed the operation.



This interesting setup reveals how a cost-minded producer is getting faster loading—and maintaining closer tolerances—in the balancing of floor polisher turbine assemblies.

One operator locates, measures and corrects 25 assemblies per hour with this setup. Balancing in the overhang drastically reduces workpiece handling while maintaining high accuracy.

250% PRODUCTION INCREASE WITH THIS SETUP

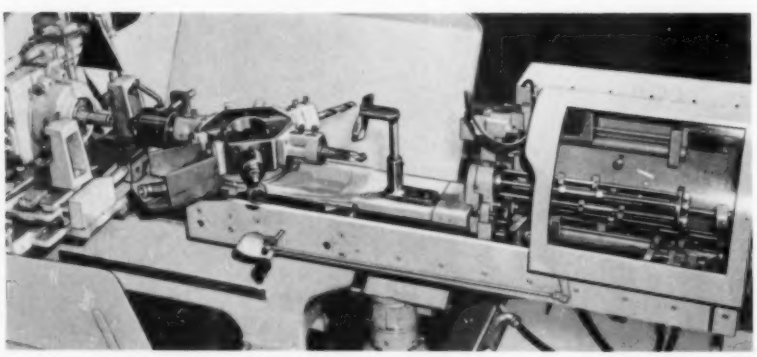
Hydraulic Drive Converts Hand-Operated Lathe to Fully Automatic Operation

You'll be impressed with how this manufacturer has accomplished full automation on small job-lot production runs. The workpieces are steel adjusting screws, produced from bar stock in a variety of sizes.

Here's how it's done on a screw 3 1/8" long with 1 11/16" diameter—automatically controlling all operations and machine functions with the Lynn Hydraulic Drive Unit mounted on the rear of the Gisholt Ram Type Turret Lathe. Fed pneumatically against a turret stop and chucked, the stock is start-drilled, then finish-bored with a large drill. The Hydraulic Drive automatically backs the drill out to clear the chips, then rapid traverses back to where it left off before dropping into feed to continue drilling. Spindle speed automatically decreases as tools on the front cross slide form the O.D.—drops into a lower speed as the O.D. is threaded—and into another low speed as radii are formed on the finished part and on the end of the bar stock. A tool on the rear cross slide cuts off the finished part, which drops into a basket mounted on the hexagon turret for easy removal by the operator.

Former f.t.f. time with the hand-operated machine on this job was 8.1 minutes—now cut to only 3.25 minutes floor-to-floor by the Lynn Hydraulic Drive, with no additional setup time required.

This setup increased production, eliminated human error, and provided automatic operation for existing equipment at the lowest possible cost per unit.



Hydraulic drive unit (right) and pneumatic bar feed provide complete automatic operation for hand-operated turret lathe. Note special cam plate on rear of turret ram to close die head as turret indexes.

Finished workpiece, completely machined from bar stock in one fast, automatic operation. Class 3 threads are no problem with the Lynn Hydraulic Drive arrangement.

WITH THE GISHOLT MASTERLINE

GISHOLT

TIME-SAVING IDEAS

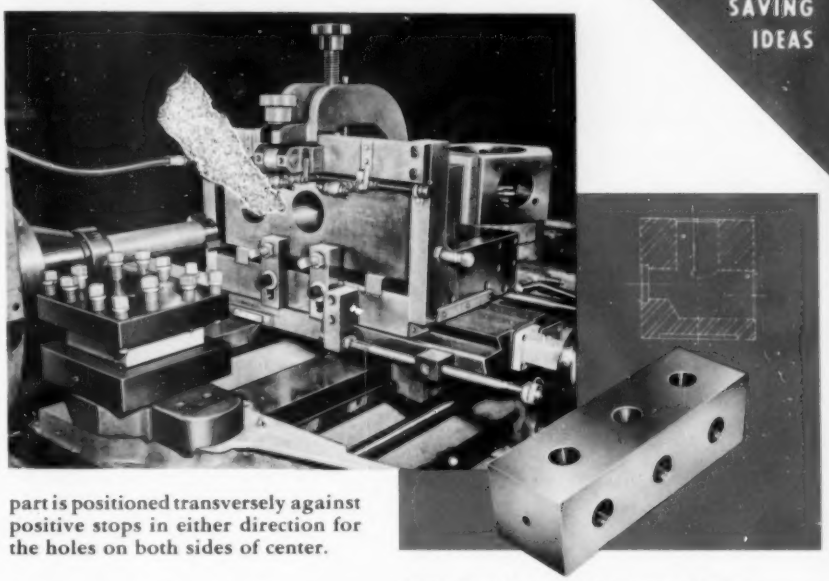
TWO MACHINES FOR THE PRICE OF ONE

Fixture Converts Standard Turret Lathe for Precision Boring Operations

Here's how Ajax Iron Works, Corry, Pa., saved the cost of a special purpose machine through smart tooling on a standard Gisholt 3L Saddle Type Turret Lathe.

The workpieces are tough steel cylinder blocks for Triplex Pressure Pumps used in oil well reclamation projects. Made in small lots in various sizes, their production could not justify a special purpose machine. Also important, the many other jobs to be performed, required a rugged saddle type turret lathe.

Ajax solved the problem with a special fixture to hold the workpiece during machining. This fixture is mounted on a bridge-type cross slide base, with a manually operated handwheel providing transverse movement. The base is attached to the hexagon turret to receive longitudinal movement. To begin machining, the block is located against a positive stop on one end and clamped on the other. For the remaining three faces, a centering plug is used in the center hole of the previously machined face for accurate location. The part is positioned transversely against positive stops in either direction for the holes on both sides of center.



Special fixture holds close tolerances easily, and when not in use is easily removed to use lathe for conventional machining operations on other parts.

Cylinder block is securely held in special fixture. Note tool mounted on spindle nose quick-change tool holder and adjustable transverse stops at lower right. All four faces are machined as per cross sectional drawing.

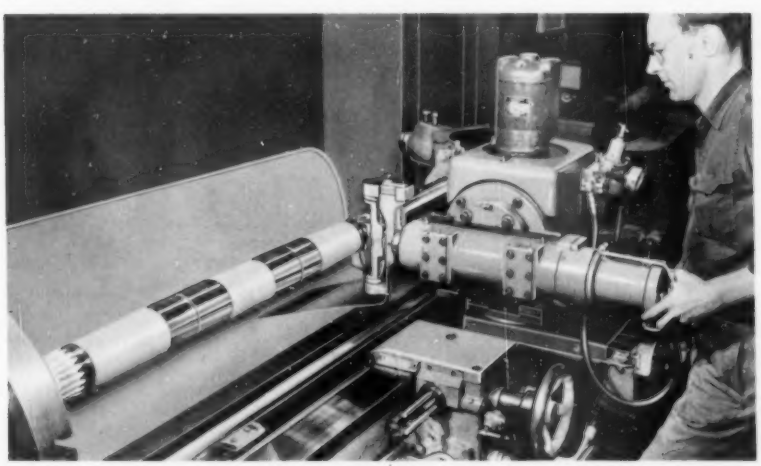
ATTACHMENT ON LATHE CUTS COSTS ON SHORT RUNS

No. 4 Superfinisher Provides Required Finish in Minimum Time, Saves Machine Investment

Here's how a cost-wise manufacturer is handling one-piece jobs on short runs not justifying the extra expense of a large machine.

The workpiece—a steel axle used on one of today's modern commercial aircraft—is of 50-53 Rockwell C hardness. To provide the fine finish and long wear life required for several surfaces, the manufacturer is Superfinishing the axles to a high degree with a No. 4 Superfinishing Attachment mounted on a turret lathe.

In addition to obtaining the 3-4 micro-inch surface finish desired, the part is also sized on this job. A slow spindle speed combines with a fast traverse and fast oscillation rate for the roughing operation, and a fast spindle speed is used with a slow oscillation and traverse rate to finish each bearing surface. By removing amorphous "smear" metal, the Gisholt Superfinishing process assures longer, safer wear-life on the axles' most critical areas.



Use of Superfinishing attachment utilizes existing machine, improves product performance and quality.

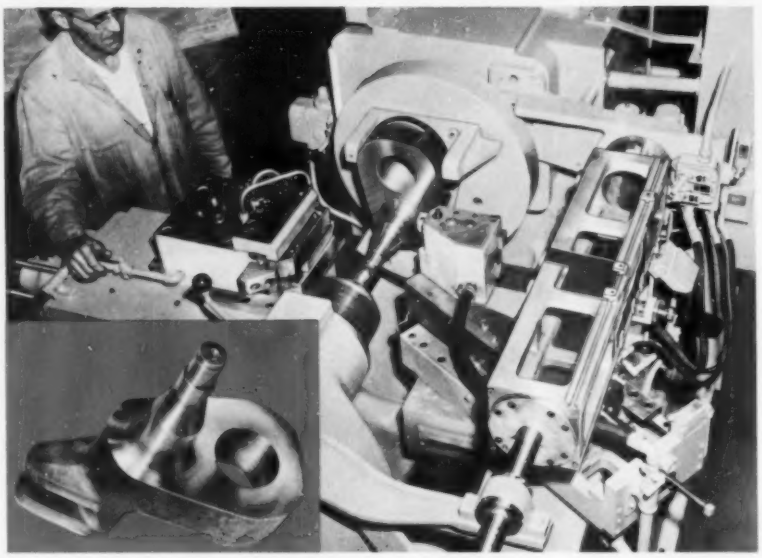
Close-up of operation, showing Gisholt No. 4 Attachment used to Superfinish 6 diameters on commercial aircraft axle.

MASTERLINE
GISHOLT SINCE 1887

TIME-SAVING IDEAS

WHIPS PROBLEM PART WITH RIGHT EQUIPMENT

Tough, Interrupted Cut and Contour Machining Easily Handled by No. 24 with Gisholt JETracer



Workpiece supported between centers using special fixture to locate and drive. Note JETracer on rear slide, with stylus at rear of cam roll. Different templates on each face are for different lengths of cut.

You'll like the way this producer is turning out steel tank idler arm forgings with the powerful No. 24 Automatic Production Lathe. Special equipment includes a JETracer on the rear independent slide, plus a 2-speed motor arrangement to provide correct machining speeds when facing and turning.

The part is held between centers, with a special face plate fixture locating the work and driving against the large O.D. radius. All cuts are made separately, with each slide performing a rough and finish pass. The front tool slide faces at 60 rpm and .015″ feed (306 fpm), and has automatic tool relief. Two tools divide the length of cut to shorten machining time. A special step-over cam arrangement repositions the front carriage and its tools for the finish pass. The JETracer—controlling the rear slide which turns all diameters on the idler arm at 180 rpm and .015″ feed (259 fpm)—uses a 4-position indexing cam roll permitting up to 4 automatic passes if needed. Floor-to-floor time on the 18″ long, 5½″ major radius part shown is just 21.1 minutes.

JETracer provides maximum accuracy with minimum operator effort; is easily set up for other workpiece sizes.

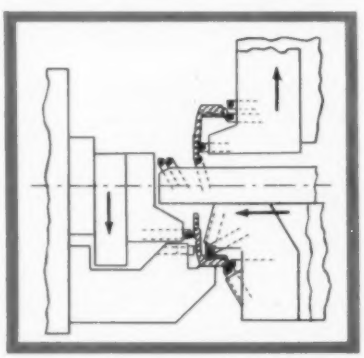
MACHINES ALUMINUM AND CAST IRON SIMULTANEOUSLY

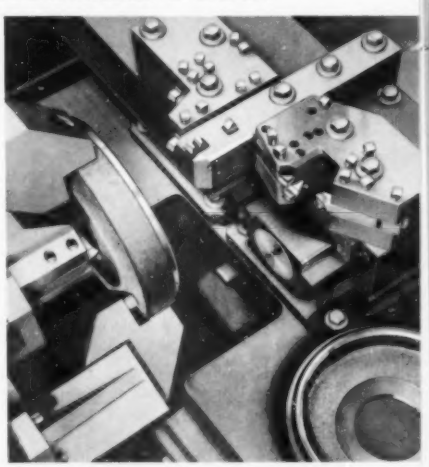
Completes Part in Single Chucking with Back-Facing Attachment on Simplimatic

Every second pays off in this job. In one chucking on a Simplimatic Automatic Lathe, the manufacturer is handling brake drums 11¾″ in diameter and 2½″ deep—machining the aluminum shell and cast iron braking surface insert at the same time and getting a fine finish on both.

The conventional air chuck could not be used, because the spindle bore had to be cleared for mounting a back-facing attachment. A power chuck wrench operates the scroll chuck, gripping the work on the O.D., locating against the back of the part. The back-facing attachment does the back side of the web, while tools on the two front slides handle all surfaces indicated on the layout.

Eleven tools machine 10 surfaces in just 2.4 minutes f.t.f. time, with minor adjustments handling either front or rear brake drums.





Close-up showing workpiece in chuck, back-facing attachment at left center and slide tooling. Note rigid support for all tools.

9-1056
667

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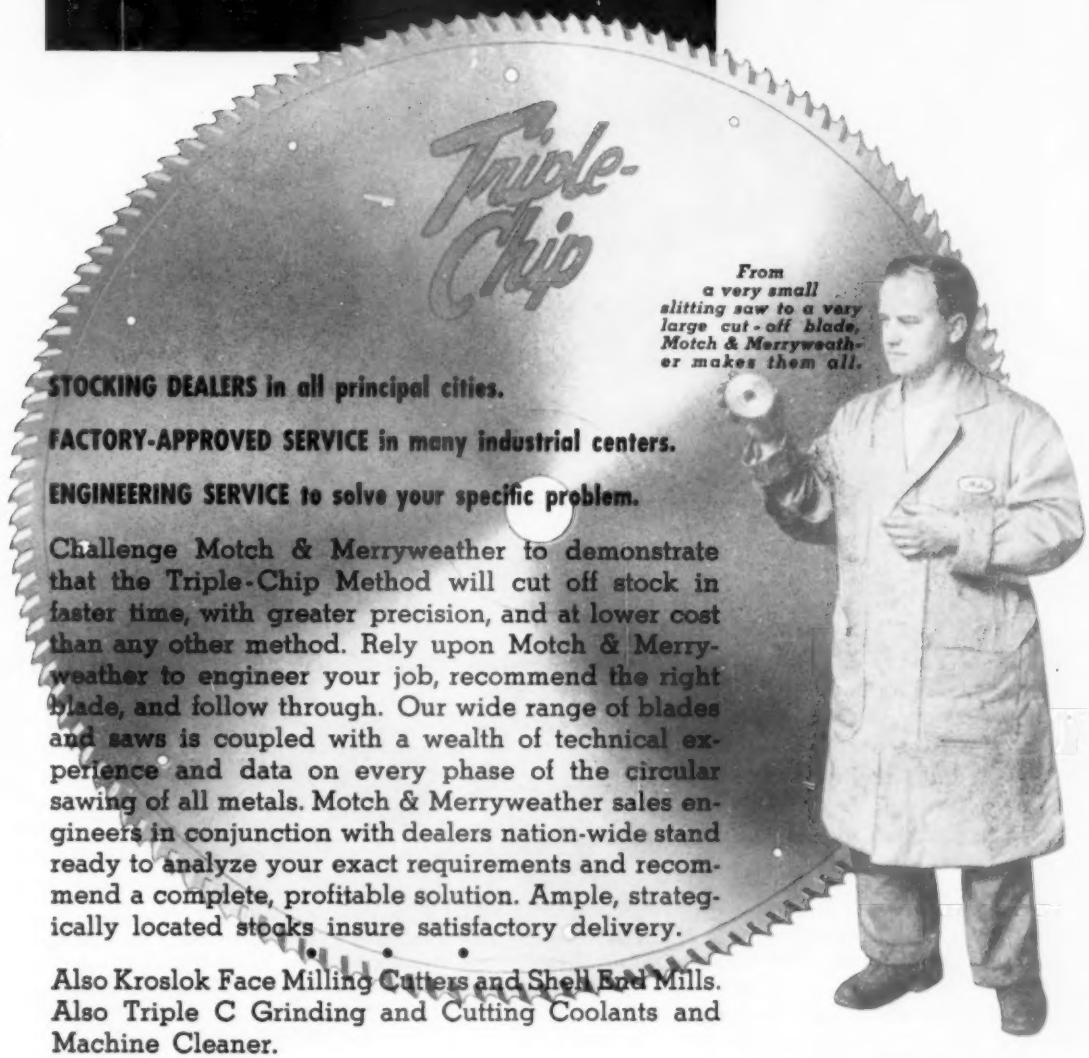

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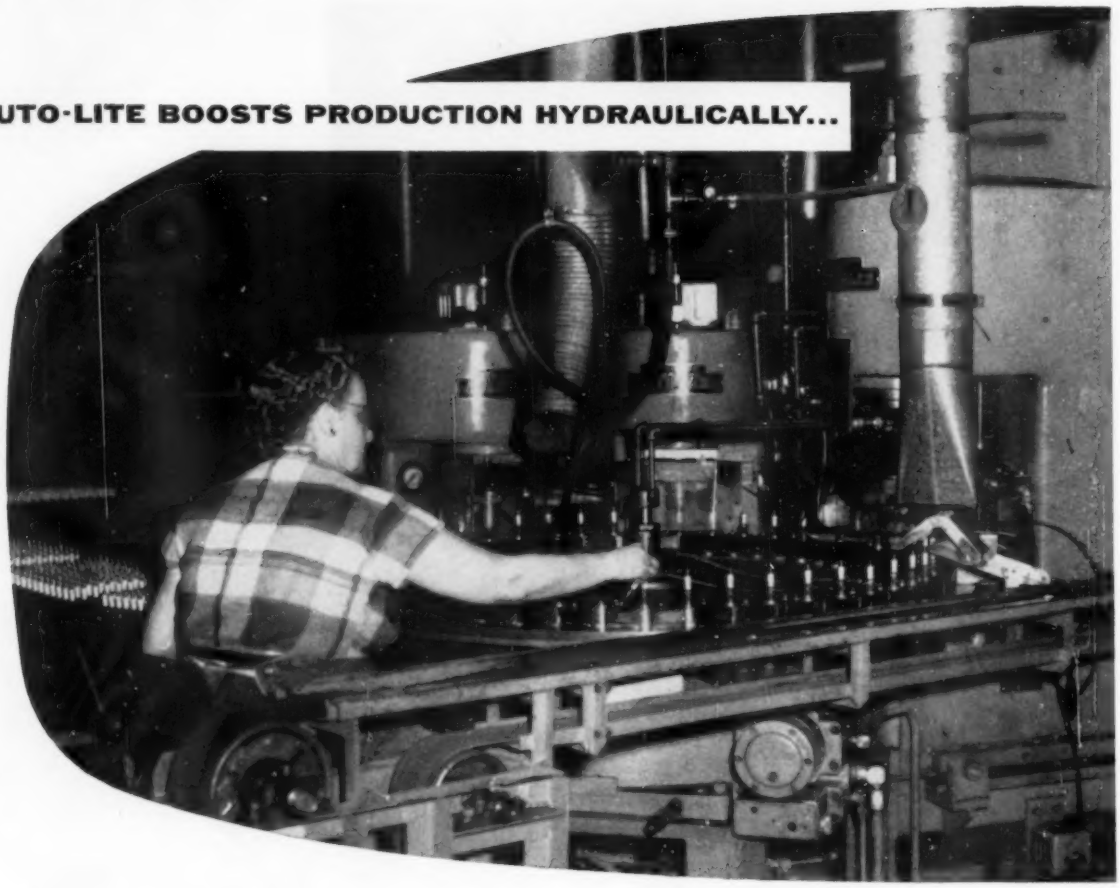
AUTO-LITE BOOSTS PRODUCTION HYDRAULICALLY...



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- ★ **Reduces tool and die costs, eliminates down-time**
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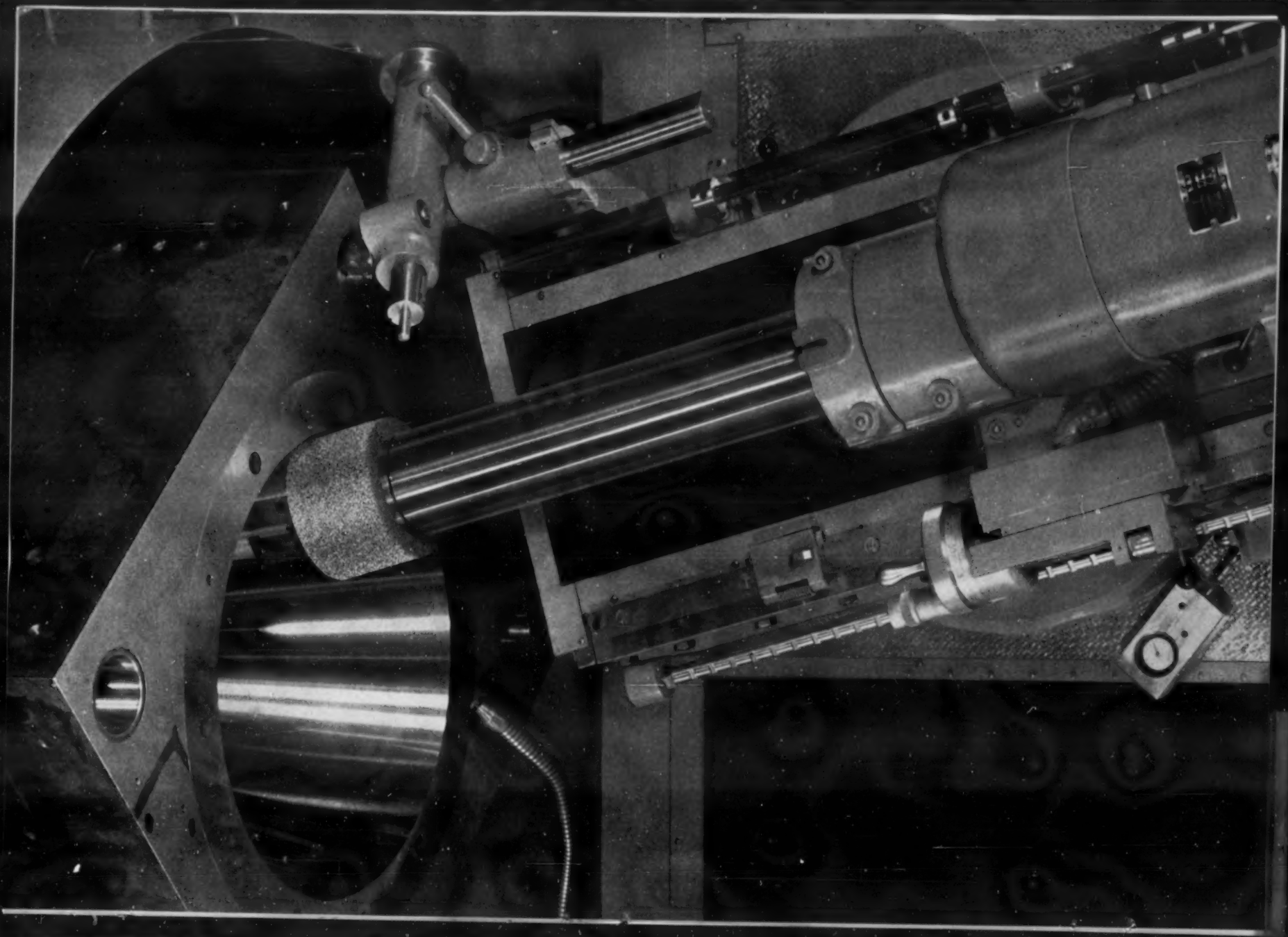

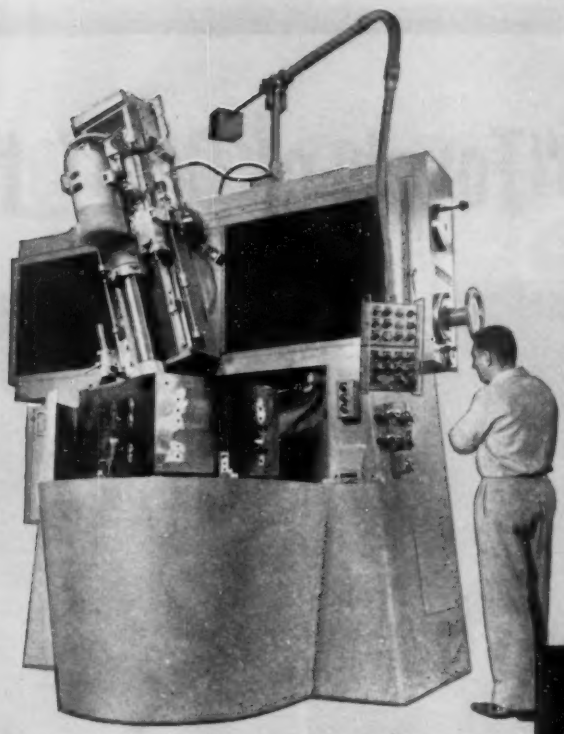

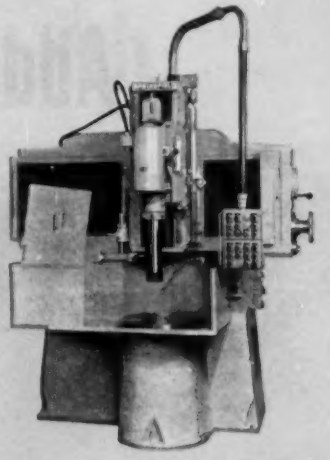

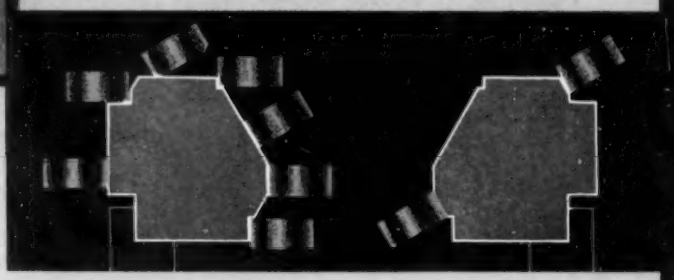

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All three models readily adaptable to special problems.

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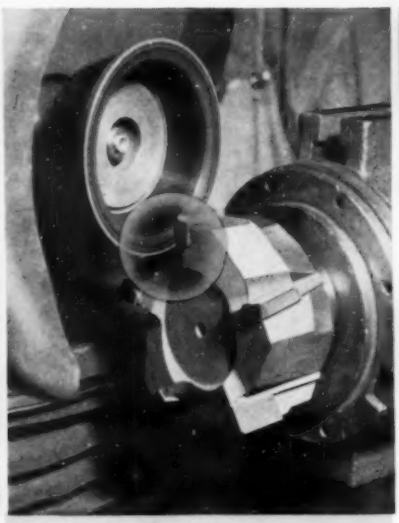

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Cut-Off Wheels made in abrasive-and-bond combinations for all tool room applications, wet or dry, on every type of machine.

every tool room grinding job

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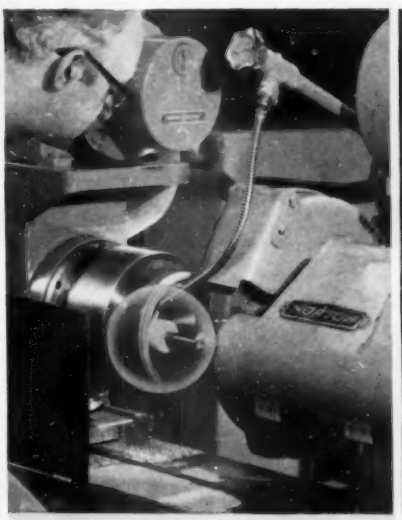
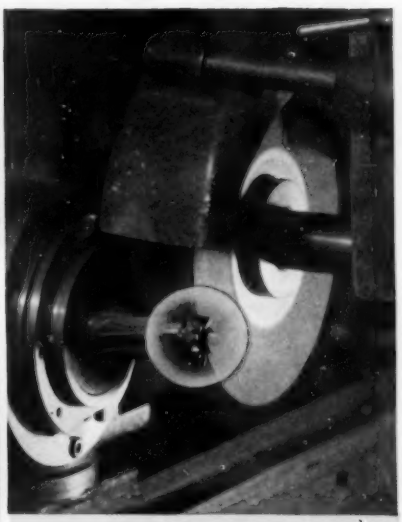


Internal Grinding



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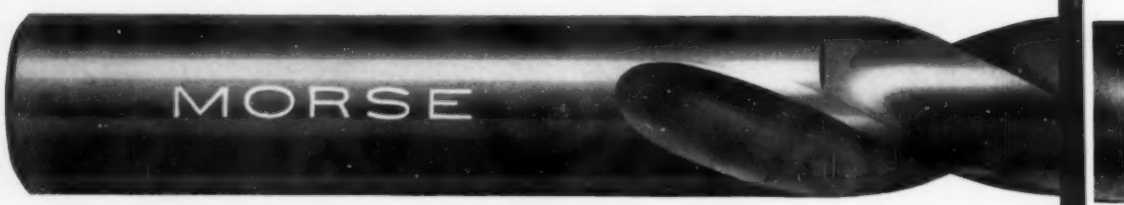

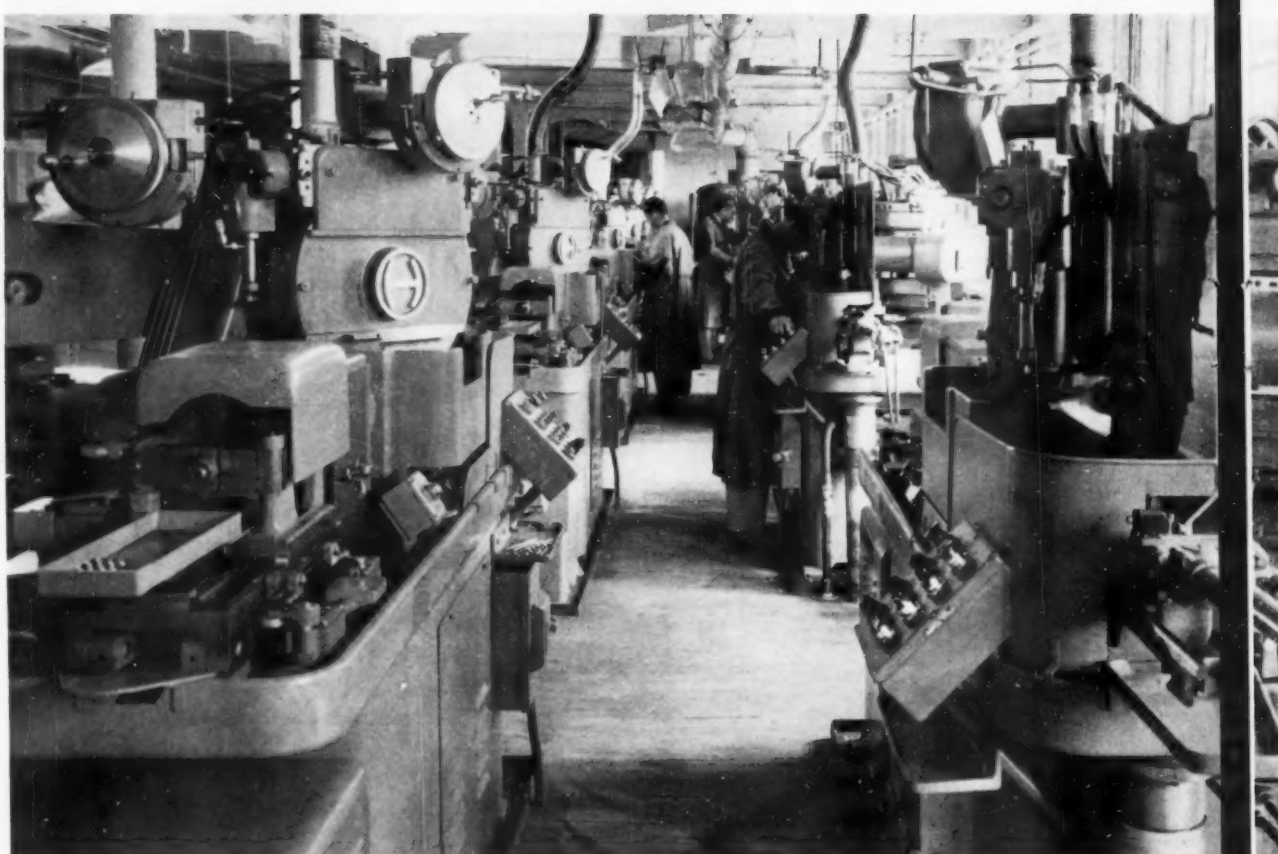

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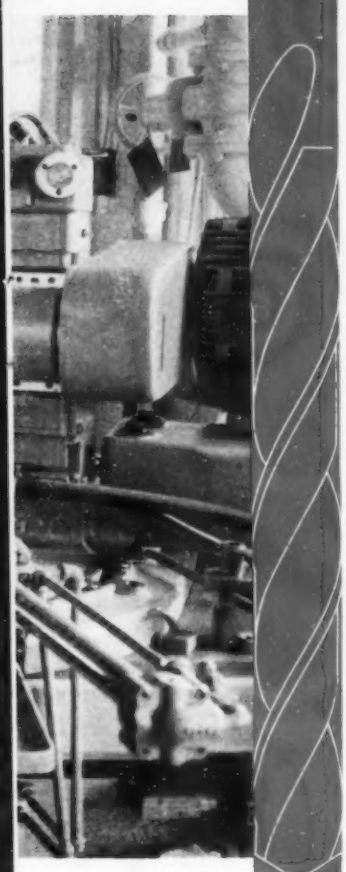

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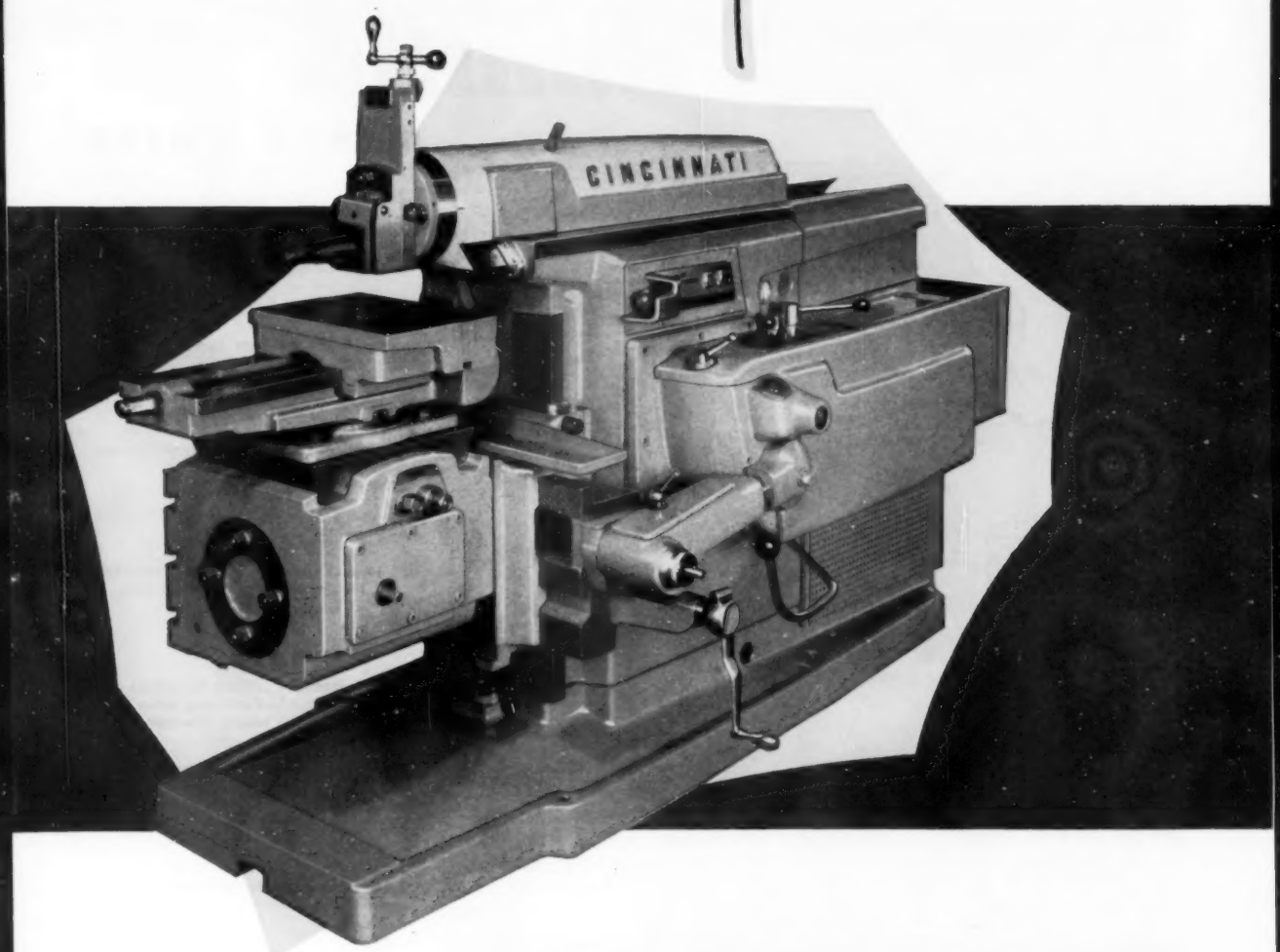
CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

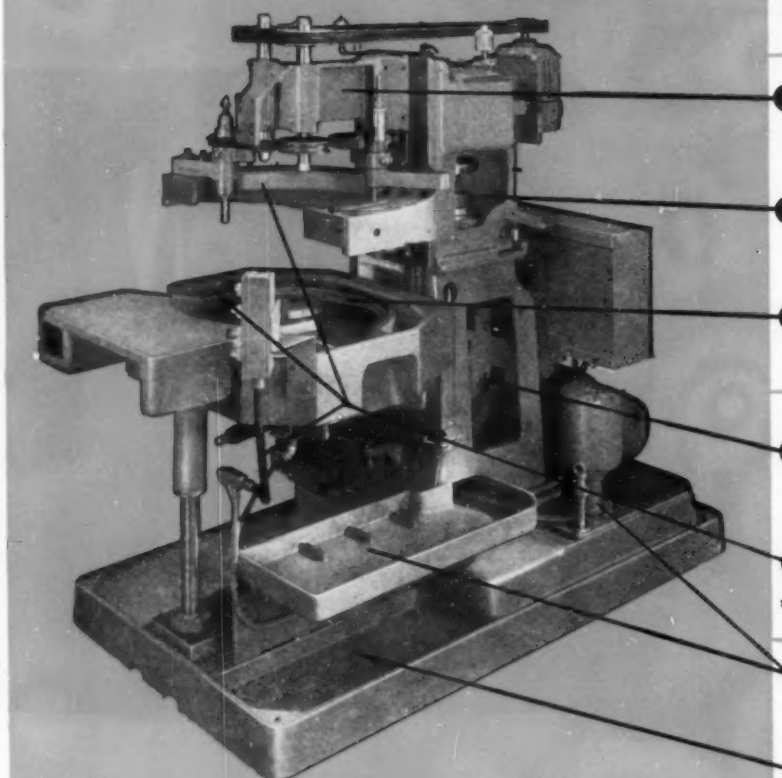
Accuracy...



Very rigid and powerful—the New Cincinnati Rigid Shapers give a new accuracy—on heavy cuts and light cuts. They have the most rigid column and ram in shaper history. The Electro-magnetic clutch and brake and 50 PSI positive lubrication are exclusive features that give continued, efficient and accurate performance.

Write for bulletin on these new Cincinnati Rigid Shapers.

SAVE TIME AND MONEY
BY BUILDING YOUR "SPECIALS"
WITH Bodine



NOTE: Front bracket removed to show spindle drive arrangement.

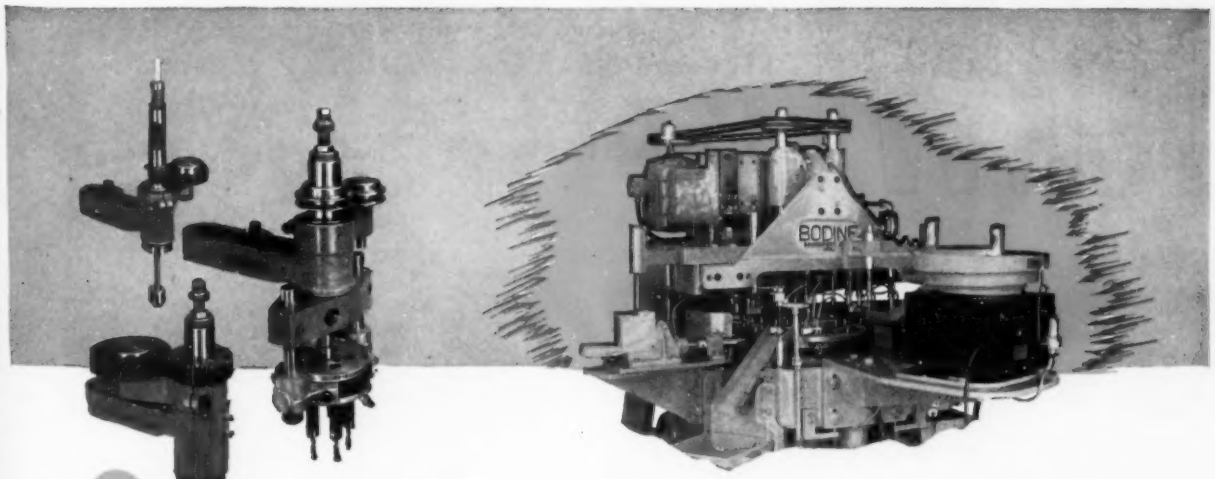
BASIC UNITS

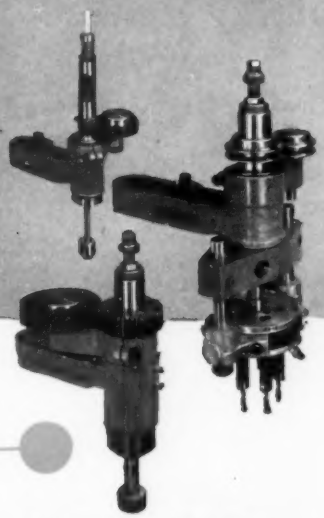
- Central and flexible jack shaft drive to vertical spindles.
- Variable, quick-change, cam-controlled, synchronized vertical motion.
- 6 standard interchangeable table indexes, from 10 to 24 stations.
- All power drive through SINGLE main shaft for simple timing and adjustment.
- Ample mounting surfaces for tooling and attachments. Tool mounting areas are standard, making all tooling interchangeable.
- Central coolant system.
- 4 standard Basic Machine sizes.

Few pieces of production equipment available today can match the practically unlimited versatility of this Bodine Basic Machine or the features it offers at such remarkably low cost. Equally important . . . while every day sees NEW developments in tooling and application, the BODINE MACHINE and standard tooling equipment remain as well-proved BASIC designs from which the "bugs" have long since been eliminated.

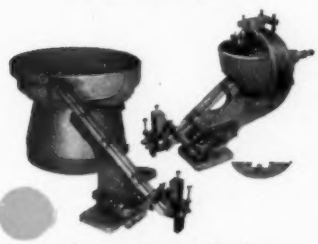
Bodine BASIC Machines are made in four sizes capable of high volume production of a wide range of small interchangeable parts, especially where multiple operations are required. The Basic Machines and spindle units may be purchased separately or in any combination by those who wish partially or wholly to design and build their own specials.

1BD56L

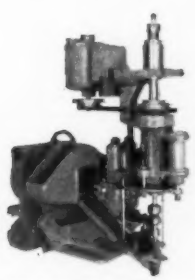




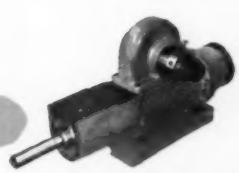
Wide range of standard spindles for drilling, reaming, tapping, threading, milling, screw-driving, etc.



Service-proved standardized automatic feed methods and units.



Screw-inserting mechanisms available as complete units.



Standardized spindles for horizontal, inverted or angular mounting.

YOUR STANDARDIZED, FLEXIBLE ANSWER TO...

HIGH PRODUCTION NEEDS

MULTIPLE TOOLING PROBLEMS

RAPID CHANGE-OVER

Time and again we hear the statement, "If we had known what can be done with a Bodine Basic Machine, we would have saved ourselves a lot of headaches in building our own specials."

Simplicity is the keynote of Bodine Basic design . . . simplicity combined with positive precision operation and control to assure accurate repetition of production cycles.

A single main drive camshaft times and controls all indexing and tool feed motions with full provision for simple, precise mechanical adjustment. This permits extremely accurate timing of all operations in the cycle with positive mechanical interlock. It also makes for ideal accessibility for changing of cams, aiding in rapid change-over.

Another important Bodine feature is the very broad range of standard spindle types and sizes available, which can be modified if necessary to meet essentially any practical need. Drill spindles are available in four standard sizes and are easily adjustable for a wide range of speeds. They carry a micrometer adjustment for extremely fine setting. Bodine specially designed tapping spindles can consistently maintain Class 2 (plus) fits. Lead screw units are available for Class 3 fits. Horizontal, angular and inverted spindles are fitted to many machines.

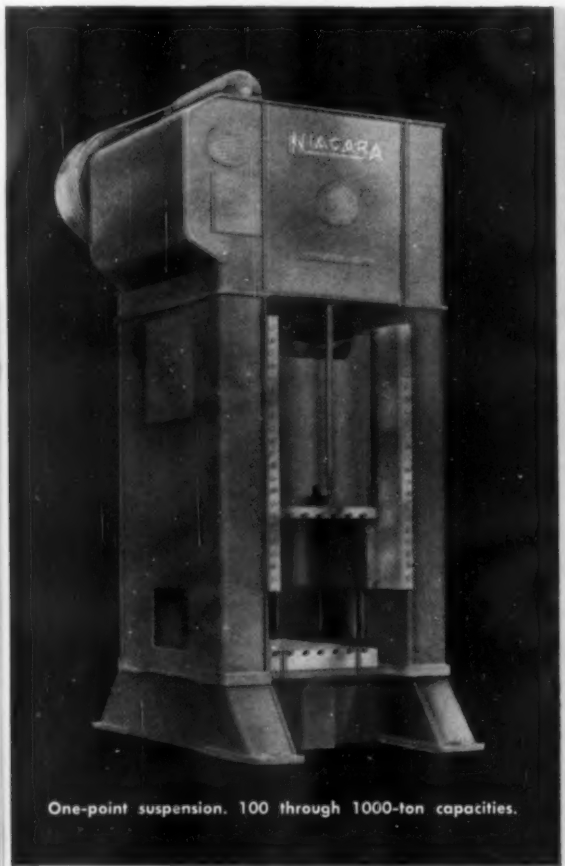
Furthermore, you no longer need to consider the investment in a "single-purpose" machine at production termination. Investigate these unusually successful Bodine Basic Machines and methods. In nine cases out of ten, we can give you a PRE-TESTED answer to your problem at far less cost. Write outlining your needs . . . or send us prints and samples for analysis . . . to Dept. TE-9.

THE
Bodine
CORPORATION
BRIDGEPORT 5, CONNECTICUT

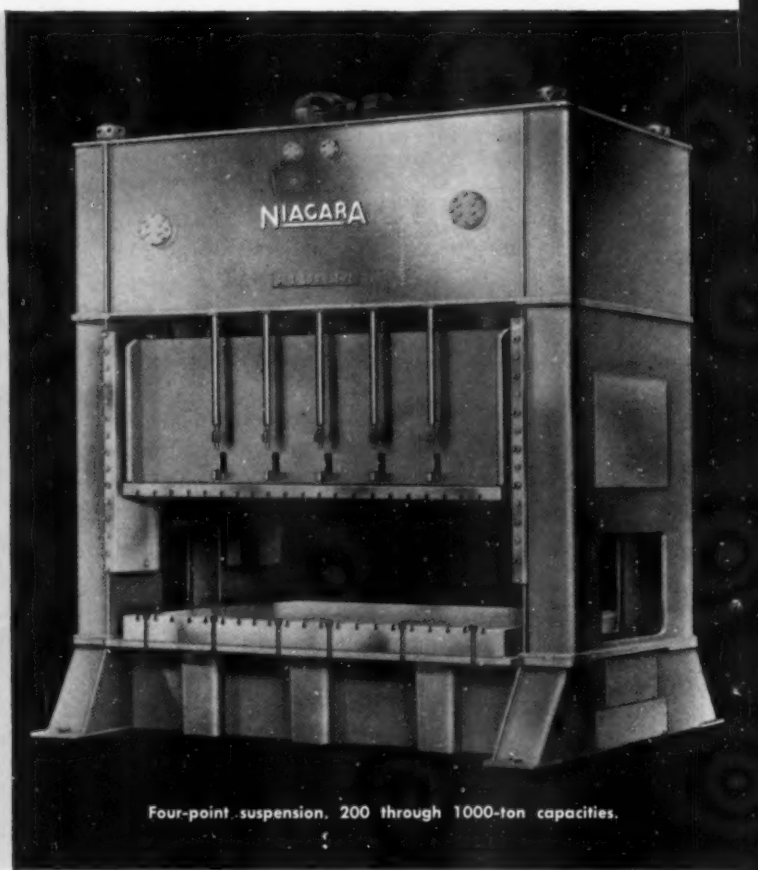
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING AND SCREW INSERTING MACHINES

NEW! MASTERFULLY ENGINEERED

excels in large, heavy tonnage



One-point suspension. 100 through 1000-ton capacities.



Four-point suspension. 200 through 1000-ton capacities.

ECCENTRIC DRIVE DELIVERS GREATER TORQUE WITH LESS DEFLECTION

In Niagara Series SE Presses, the eccentric is an integral part of the main gear (or gears) which rotates on a stationary pin rigidly supported in the crown, close to the point at which the pressure is exerted. Serving merely as a pivot, the pin carries no torsional load and relatively little bending load. Net result: Niagara's eccentric gear design can deliver greater torque with less deflection than other types of construction.

RUGGED, RIGID, ALL-STEEL FRAMES PROVIDE GREATER ACCURACY, LONGER DIE LIFE

Frames are rugged, all-steel, four-piece, tie-rod construction of great strength and rigidity, stress relieved in a furnace and thoroughly grit-blasted before machining. Each frame size has been scientifically tested for deflection to meet Niagara standards — the most exacting in the industry.

LOW INERTIA, PNEUMATIC FRICTION CLUTCH RUNS COOLER, WEARS LONGER

Most of the weight of the Niagara clutch continues to rotate with the flywheel. Only the drive shaft and driving plate start and stop with each cycle. The resulting low weight and inertia of the parts, picked up during clutch engagement, greatly reduce heat and wear. As the clutch rotates, it acts as a centrifugal blower, providing positive ventilation. Plates automatically compensate for normal wear, with no adjustment necessary.

MODERN, STREAMLINED DESIGN EMPHASIZES COMPACTNESS

The entire driving assembly is neatly housed in the crown. There is no exposed, overhanging flywheel, clutch, brake, shaft nor motor in the rear of the press to obstruct crane service, block light, throw grease or consume space unnecessarily.

LINE OF METALWORKING CHAMPIONS

drawing, punching and blanking work

Two-point suspension. 200 through 1000-ton capacities.

Without equal in engineering design, performance and stamina, this great new line of Niagara Straight Side Eccentric Geared Presses is every inch a champion. It is an outstanding example of the advanced thinking that has made Niagara the pace-setter among builders of metal working machines for 75 years.

Masterfully engineered and ruggedly constructed to handle a tremendous variety of work, the new Niagara SE Series is the most practical and dependable press line built for:

- Work requiring large die areas.
- Heavy tonnage demands.
- Long stroke, deep drawing jobs where work is engaged high up on the stroke.
- Bottom-of-stroke blanking and punching.

THE COMPLETE STORY IS READY FOR YOU NOW!
Make a feature-by-feature appraisal of what these great new presses can do for you. Write for newly published, illustrated Bulletin 66. It will be forwarded promptly without obligation.

NIAGARA MACHINE & TOOL WORKS • BUFFALO, 11, N.Y.
DISTRICT OFFICES:
BUFFALO • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA
Dealers in principal U.S. cities and major foreign countries.

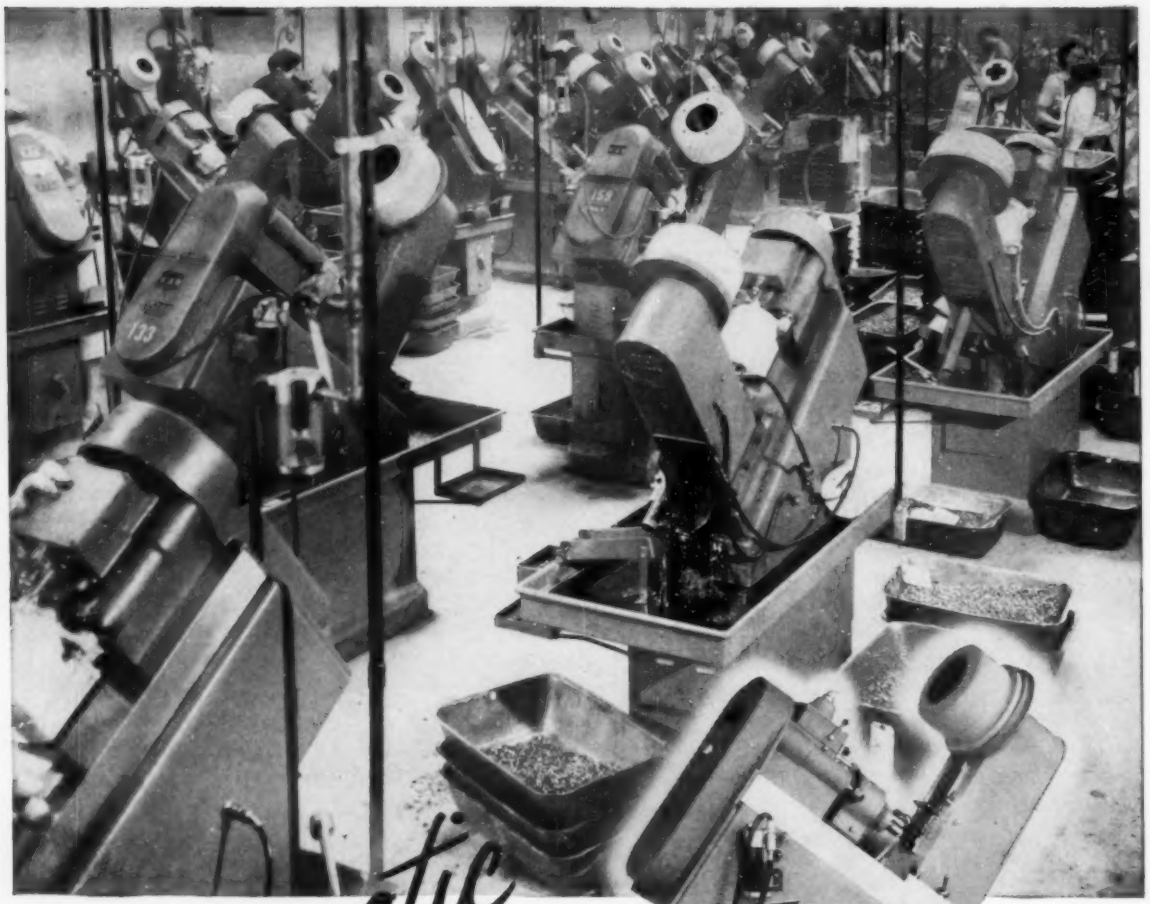
DELUXE OPERATING CONTROLS INSURE UTMOST SAFETY, EFFICIENCY AND CONVENIENCE

Compactly and conveniently arranged on a master panel, Niagara controls are instantly accessible for fingertip direction of every press operation: starting, slide adjusting, jogging, die tryouts, running and stopping. The latest safety devices provide maximum protection for die setter, operator and the press itself. Nothing has been overlooked. Trial runs assure that all controls are in proper working order before each Niagara press leaves the plant.

NIAGARA

STRAIGHT SIDE ECCENTRIC GEARED PRESSES

America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work



Automatic NUT TAPPING MACHINES

This installation *at Shakeproof, Division of Illinois Tool Works, Elgin, Illinois,* is an illustration of productivity—*with precision.*

Simplicity of set-up and lower operational costs can make your Nut Tapping Department one of the most efficient and profitable in your plant. Submit samples and prints for a comparison with your present method.

VERTICAL DRILLING MACHINES
VERTICAL TAPPING MACHINES
VERTICAL THREADING MACHINES
TWO SPINDLE MACHINES
ANGULAR MACHINES
NUT TAPPING MACHINES
HORIZONTAL MACHINES
DRILLING AND TAPPING UNITS
AUTOMATIC JIGS AND FIXTURES
DRILL PRESS TAP HEADS

SNOW

MANUFACTURING COMPANY

435 EASTERN AVENUE, BELLWOOD, ILL.

(Suburb of Chicago)

√Check and √√Double Check

Pitch diameter of plug thread gages is best measured by laying super accurate "wires" between threads at opposite sides and taking a reading over the wires on an instrument set to gage blocks.

But even gage blocks wear undersize with use. That's why "Greenfield's" master set is never used to set an instrument. It is used only to calibrate reference blocks which in turn calibrate the "working" blocks.

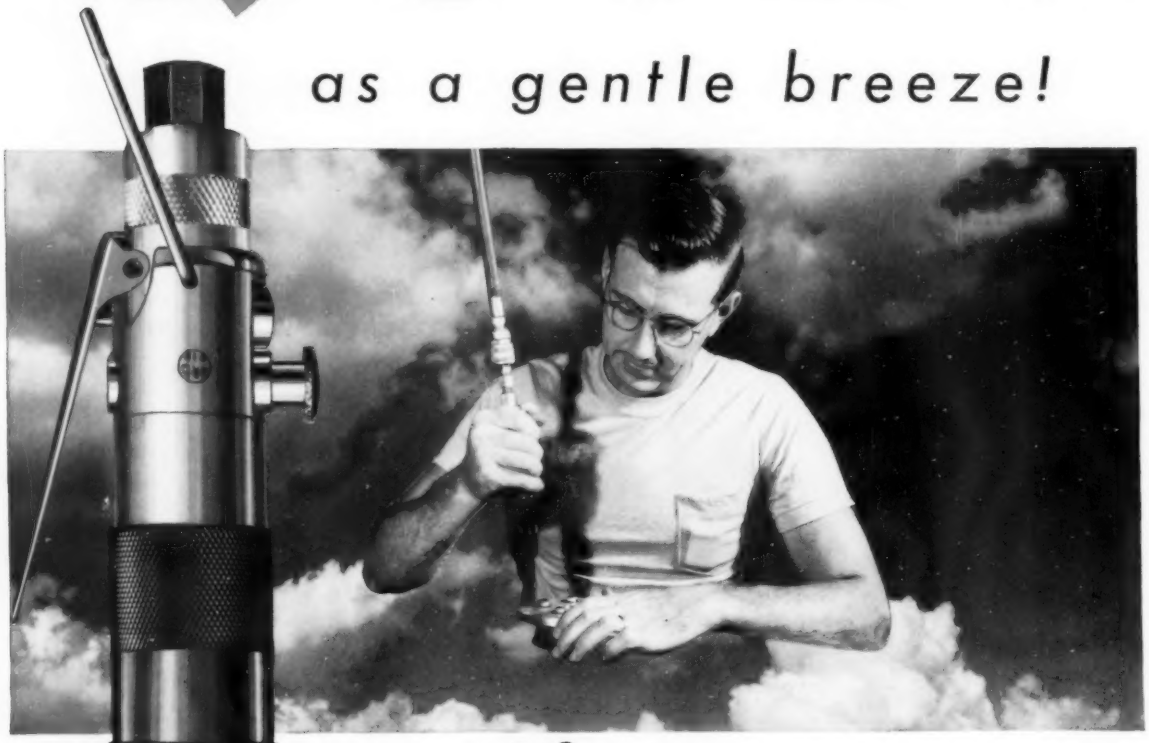
Key to this system of check and double check is a calibration sheet recording the known deviation of each setting block in millionths of an inch. This deviation is applied to the instrument reading to assure the most exact possible measurement.

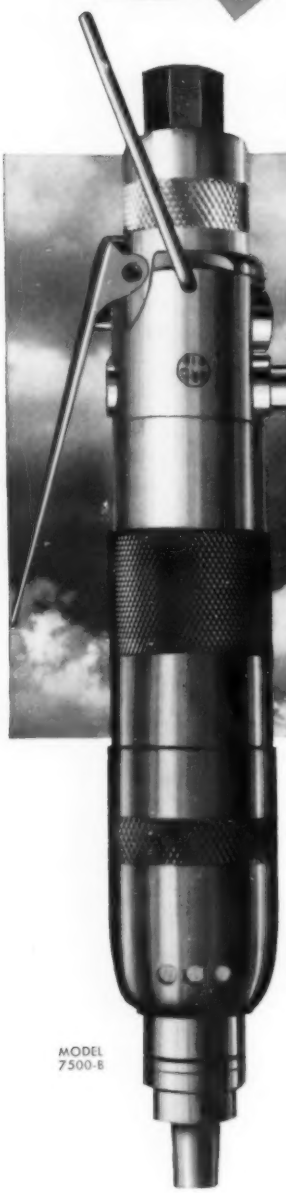
Gage inspection at GREENFIELD involves many other meticulous, time consuming checks in a constant temperature room where gages are "acclimated" at least six hours before measuring.

GREENFIELD TAP and DIE CORP. GREENFIELD, MASS.

QUIET

as a gentle breeze!





MODEL 7500-B

New ARO

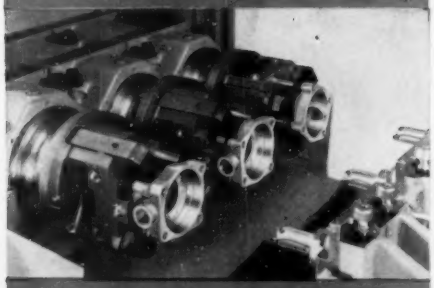
DULCETONE SCREWDRIVER

"Whispers while it works"

Reduce noise to a whisper in your assembly operations . . . cut down operator fatigue . . . use ARO Dulcetone Air Screwdrivers! This slim compact tool runs with a *quiet gentle* exhaust. Light weight . . . 1800 r.p.m. Capacity No. 8 nuts and machine screws. Dulcetone Screwdrivers now offered as standard tools . . . immediate delivery. Ask your ARO Distributor for a demonstration.

THE ARO EQUIPMENT CORPORATION
Bryan and Cleveland, Ohio
Aro of California, 3141 S. Grand Ave., Los Angeles 7
Aro Equipment of Canada, Ltd., Toronto 15, Ontario
Offices in All Principal Cities

ARO® **AIR TOOLS**
Also...Air Hoists...Lubricating Equipment...Aircraft Products ...Grease Fittings



Showing parts mounted in the chuck. Without chuck changes, any of three parts having different exterior forms but identical interior contours can be accommodated.

Intricate contouring is fast, accurate—

12 operations in one cycle!

Direct cam action—no levers—provides Ex-Cell-O Precision Boring Machines with accuracy, versatility and speed in difficult contouring operations.

In the application shown here—contouring an internal form in die-cast aluminum end covers—limits on diameters are held as close as plus or minus .0005 inch, and three work pieces are completed at a time. 12 separate operations are performed in one machine cycle, including precision boring, facing, chamfering and grooving.

Cams can be changed in minutes. Cam assembly swings out for quick, easy change. All motors are outside the base.

Another Ex-Cell-O feature is the large chip chute, cast as an integral part of the base. There are no openings where chips or coolant can enter the base. Contact your Ex-Cell-O representative or write direct for complete information.

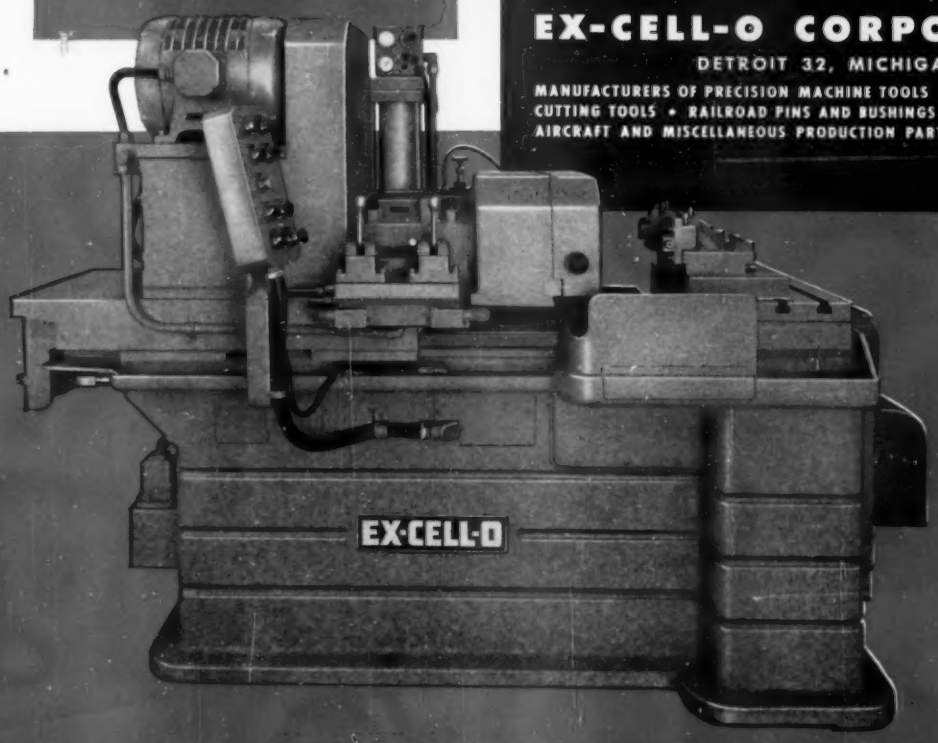
12 operations are performed in one machine cycle. Heavy lines denote surfaces machined.

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-52



XLO

At left: The Ex-Cell-O Styled 312 Cam Operated Precision Boring Machine. A smaller model, the Ex-Cell-O Style 308, is also available because of the demand for this type of machine.

LINDBERG INDUCTION UNIT IMPROVES HEAT TREATING PROCESSES AT J.I. CASE...

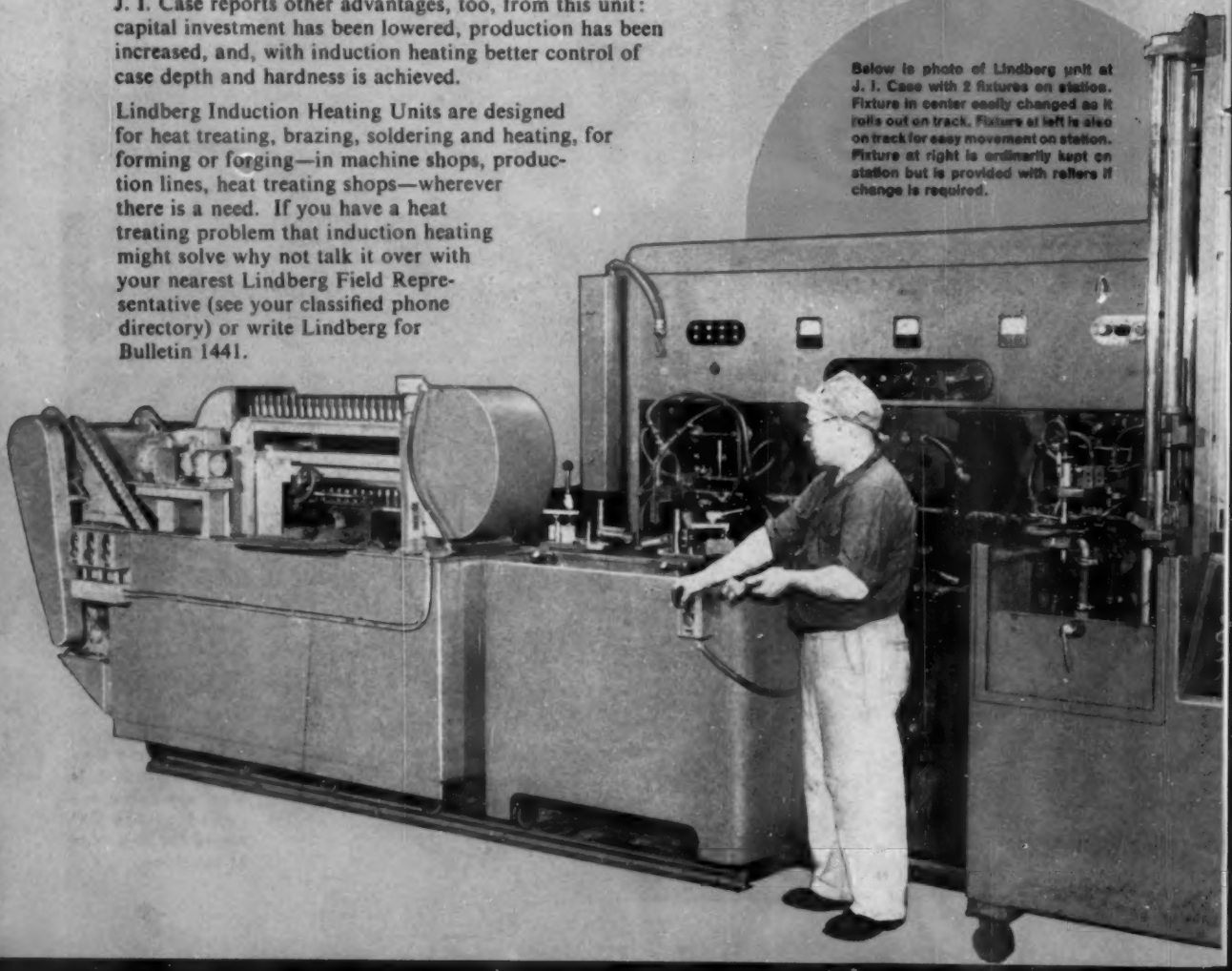
SAVES ½ ITS TOTAL COST— IN 1 YEAR!

A single Lindberg 2-station High Frequency Induction Heating Unit at J. I. Case Co., Racine, Wisc., is providing a happy combination of sizeable cost savings and improved quality and production efficiency in heat treating parts for Case tractors. Actually, the dollar savings effected with this Lindberg unit will repay its total original cost in *less than 2 years!*

This single unit and the five work fixtures provided with it, working on 2 to 3 shifts, 5 days a week to meet production requirements, heat treat some 63 separate tractor parts. Work fixtures are readily changeable, set-up time is materially reduced, and because of the 2-station design, the unit can operate continuously while work fixture is being changed over on one station.

J. I. Case reports other advantages, too, from this unit: capital investment has been lowered, production has been increased, and, with induction heating better control of case depth and hardness is achieved.

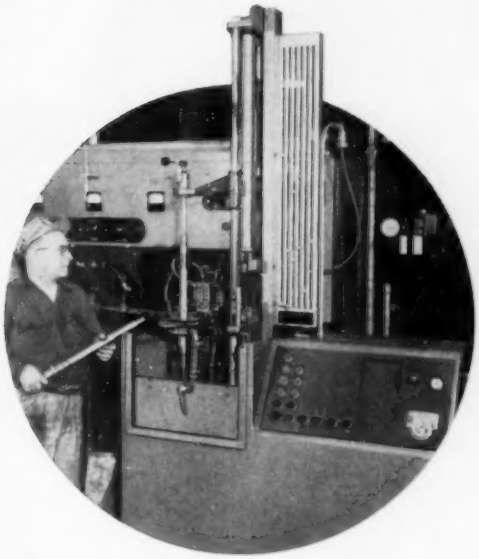
Lindberg Induction Heating Units are designed for heat treating, brazing, soldering and heating, for forming or forging—in machine shops, production lines, heat treating shops—wherever there is a need. If you have a heat treating problem that induction heating might solve why not talk it over with your nearest Lindberg Field Representative (see your classified phone directory) or write Lindberg for Bulletin 1441.



Below is photo of Lindberg unit at J. I. Case with 2 fixtures on station. Fixture in center easily changed as it rolls out on track. Fixture at left is also on track for easy movement on station. Fixture at right is ordinarily kept on station but is provided with rollers if change is required.

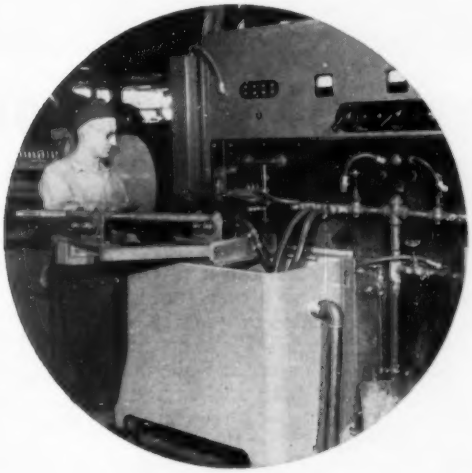
(Above) Hydraulic male coupling is being treated on this fixture. 3 other parts are treated by it, too.

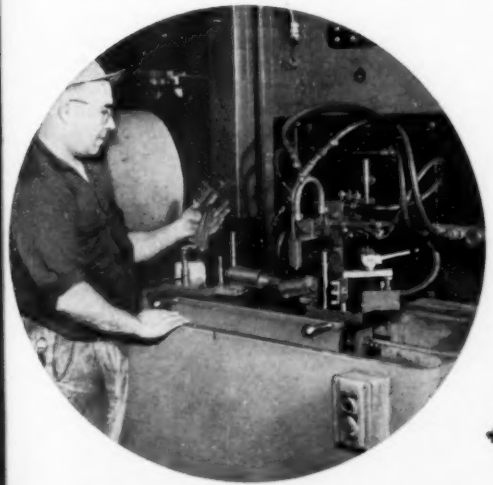
(Below) This fixture is shown selectively hardening a front axle king pin. It handles piece up to 45¼" long, 35" of which can be scanned to desired depth. It is also used for 34 other parts.



(Below) Power take-off hydraulic drive shafts are one of the 3 parts treated by this fixture.

(Above) This shows fixture handling inlet and exhaust valve rocker arms. Same fixture treats 6 other parts.





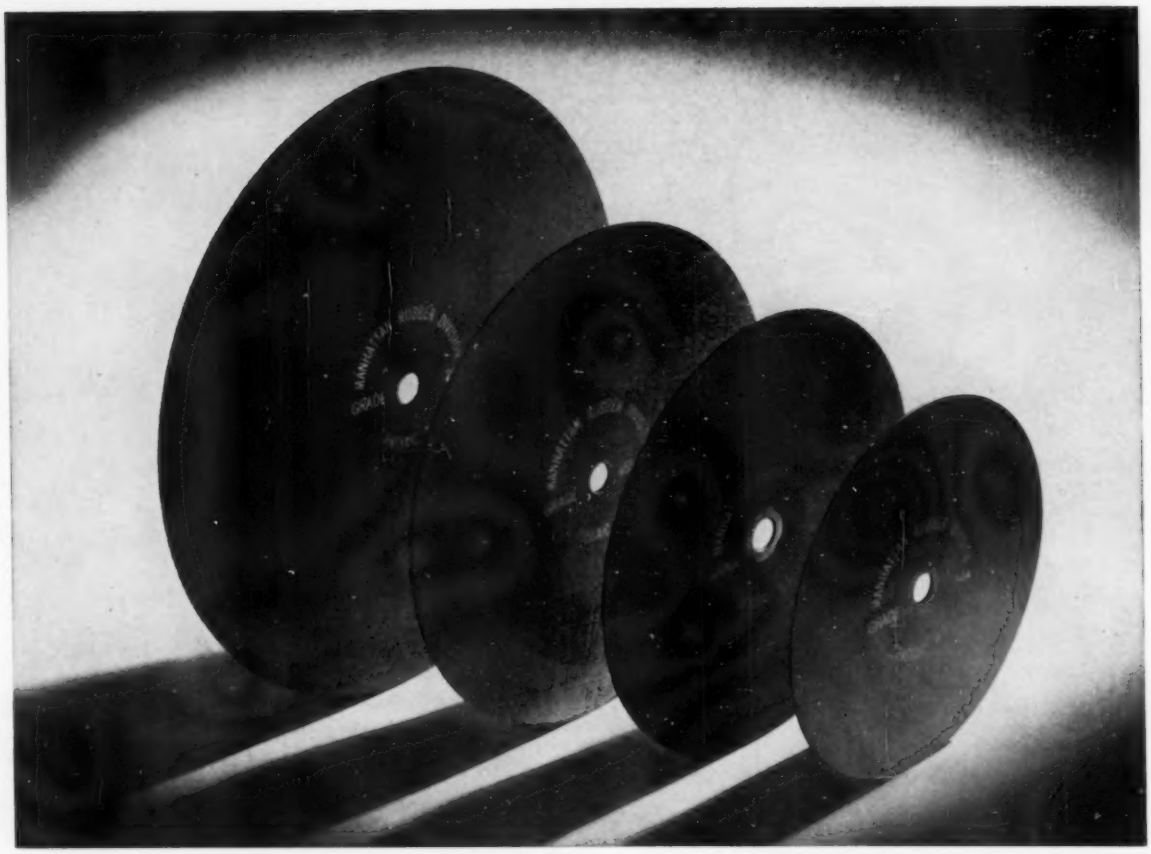
(Above) This fixture is selectively hardening pads and slots on shifter forks. It is also used for treating 17 other parts.

LINDBERG

HIGH FREQUENCY DIVISION

Lindberg Engineering Company

2447 West Hubbard St., Chicago 12, Ill.



Cleaner Cutting . . . Longer Wheel Life with MANHATTAN CUT-OFF WHEELS

Safe, fast, clean cutting over sustained periods saves you both time and money. Manhattan Cut-Off Wheels give you cleaner cutting at higher speeds because every wheel is custom-bonded for your specific cut-off job . . . whether you work with hardened or soft steel, light gauge tubing or critical alloys. New Manhattan developments in both rubber and resinoid bonds account for this greater cutting efficiency . . . and longer life for the wheels. In factories where records are kept of the number of cuts per wheel, Manhattan wheels have proved they do a better job . . . and *last longer* than any other wheels.

Manhattan Cut-Off Wheels are custom-manufactured for your requirements in the widest range of types and sizes. Manhattan Abrasive Wheel engineers will assist you in specifying the exact construction to improve cut-off operations at your plant. They'll show you how you can save time and money . . . get "More Use per Dollar" . . . with Manhattan Cut-Off Wheels and other types of high speed, heavy duty wheels.

RM-630

WRITE TO ABRASIVE WHEEL DEPARTMENT

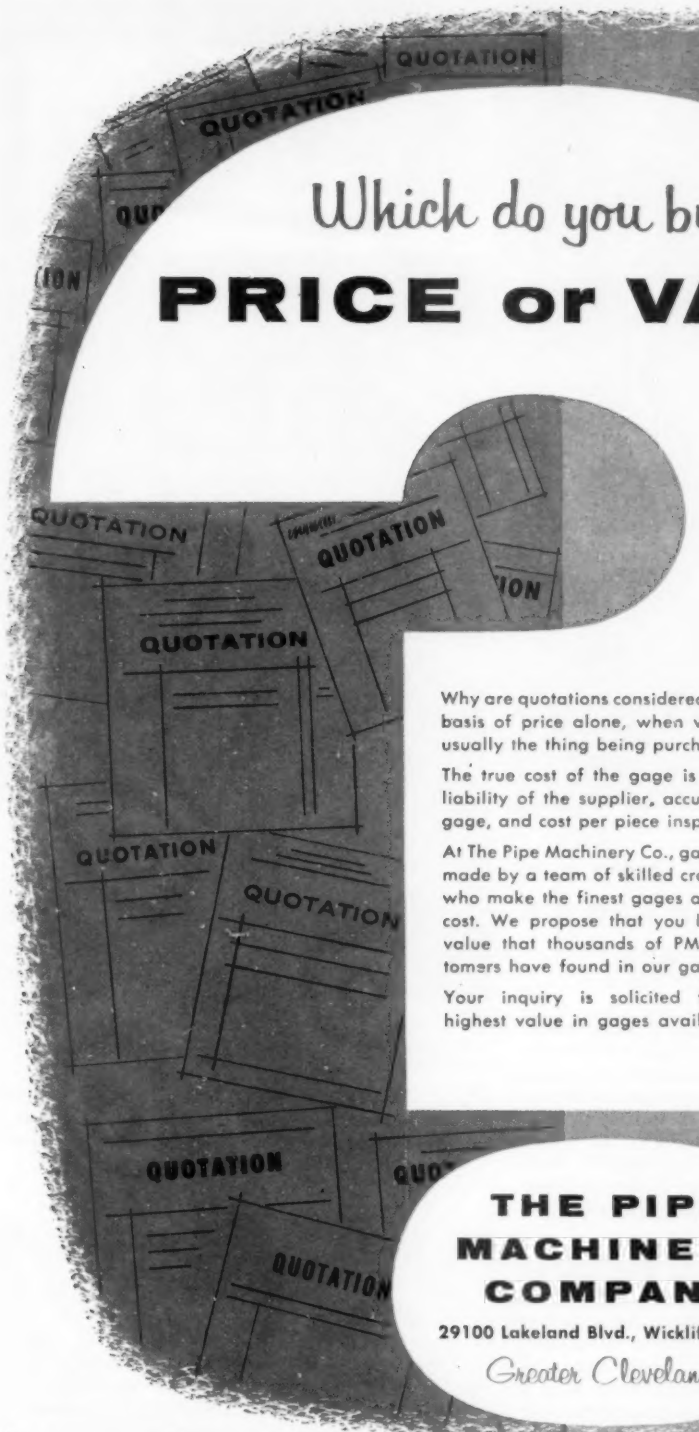
MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Laundry Pads and Covers • Bowling Balls

Which do you buy...

PRICE or VALUE



Why are quotations considered on the basis of price alone, when value is usually the thing being purchased?

The true cost of the gage is the reliability of the supplier, accuracy of gage, and cost per piece inspected.

At The Pipe Machinery Co., gages are made by a team of skilled craftsmen who make the finest gages at a fair cost. We propose that you buy the value that thousands of PMCo customers have found in our gages.

Your inquiry is solicited for the highest value in gages available.

THE PIPE MACHINERY COMPANY

29100 Lakeland Blvd., Wickliffe, Ohio

Greater Cleveland

Today Get the Pipe Machinery Co. Catalog #14. Fill in this coupon.

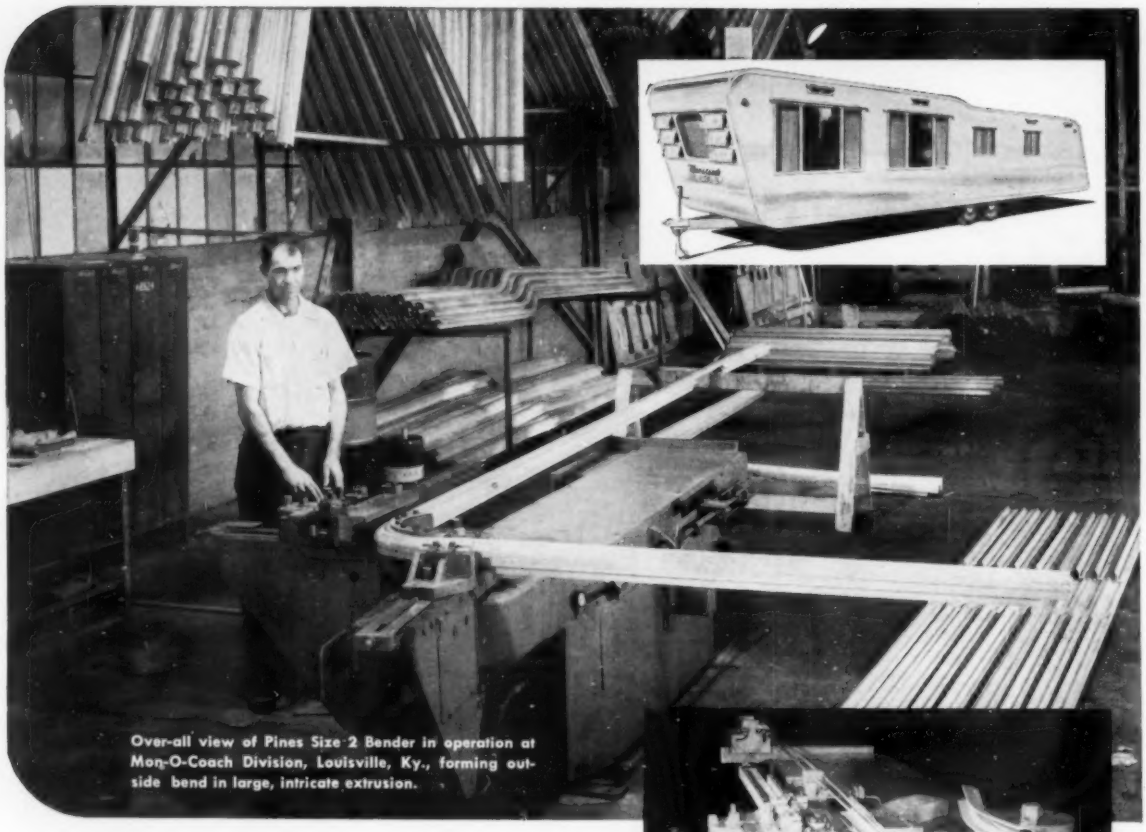
Name _____

Company _____

Title _____

Address _____

City _____ Zone _____ State _____



Over-all view of Pines Size 2 Bender in operation at Mon-O-Coach Division, Louisville, Ky., forming outside bend in large, intricate extrusion.

▲ View of tooling for making offset bend in opposite direction. Two plug-type mandrels support inner walls. Smooth, neat bends are formed at a bending arm speed of 6.0 r.p.m.

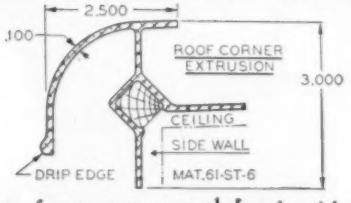
PRODUCTION BENDING ALUMINUM EXTRUSIONS THE "PINES-WAY"

The new, luxurious Mon-O-Coach Mobile Home, manufactured by Mon-O-Coach Division, Ironwood Trailer Coaches, Inc., Louisville, Ky., is a marvel in modern metals engineering. It features all-aluminum structural members which are now cold formed and shaped accurately by production bending methods. Previously, many of the bends were formed by slitting and hand-bending a section, then re-joining the slotted section by welding. Today, a Pines Size 2 Production Bender handles these jobs fast and efficiently.

Slitting and Welding Operations Eliminated

All curved sections are now cold formed in a single operation, including an offset bend in an opposite plane in one of the most ingenious extrusions probably ever developed for the automotive industry. Shown in drawing, this large unique extrusion, incorporating a 5/8" wood section, is a top corner section which serves as a means of fastening top, sides, and front panel members together. Tooling by Pines forms neat, smooth bends without excessive distortion or wrinkling, completing the piece with the wood section in place. Previous slitting and welding operations are eliminated.

▼ Cross-section of Mon-O-Coach's intricate, top corner extrusion. Hollow center incorporates 5/8" wood section installed before bending—serves as a means for fastening wall studdings.



Write FOR MORE DATA

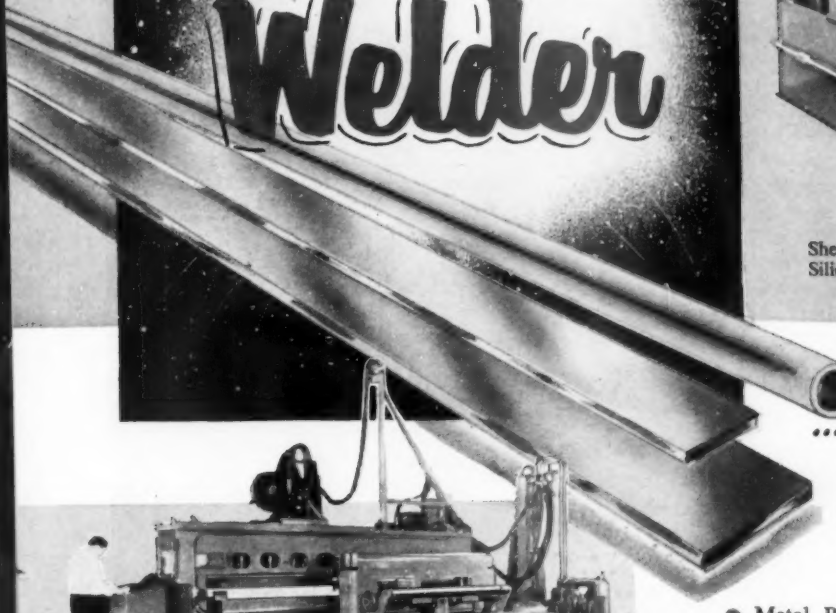
If you would like more data on production bending of aluminum extrusions the "Pines-Way", write for free copies of "Pines News". Or ask for a Pines engineer to call and assist you with any production problem.

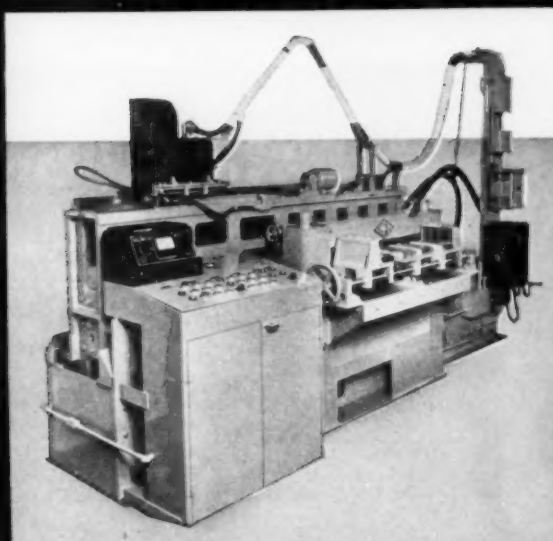
PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery · 693 WALNUT · AURORA, ILLINOIS

PRODUCTION BENDING · DEBURRING · CHAMFERING MACHINERY

THE NEW MPM Shear Welder





CONTINUOUS SILICON SHEET PRODUCTION

Shearwelder for coil build up line for 42" wide Silicon Steel from .015" to .030" thick.

HEAVY GAUGE STAINLESS PRODUCTION

Shearwelder for butt welding 60" wide x .250" thick Stainless Steel.

.....more automation for even faster Steel Production!

● Metal Processing Machine Company's new Shearwelders are outstanding because of their advanced design incorporating automatically sequenced operations.

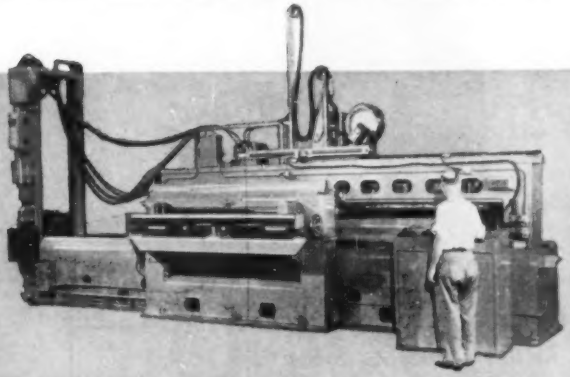
Shearing and welding are performed at the same station with positive clamping right at the work area, thereby insuring perfectly aligned butt welds.

"M.P.M." welds are **extremely ductile,** permitting subsequent rolling, forming, or blanking operations. Weld joints are smooth and require **no trimming.**

Rugged construction is insurance for minimum maintenance and compact design saves floor space.

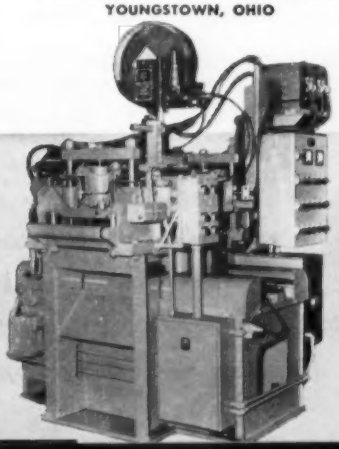
THE METAL PROCESSING MACHINE CO.

DIVISION OF McKAY MACHINE CO.
YOUNGSTOWN, OHIO



MAJOR COIL BUILD UP

Shearwelder for Carbon Steel coil build up line for .015" to .060" thick x 72" maximum width.



CONTINUOUS TUBE MILL PRODUCTION

Shearwelder used with strip looping device for splicing coil to coil to permit continuous production of tube mill.

10065

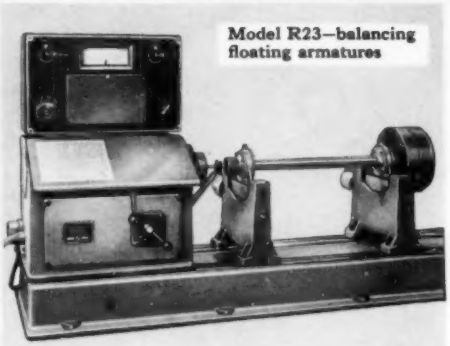
PRODUCTION . . . BALANCING

WITH

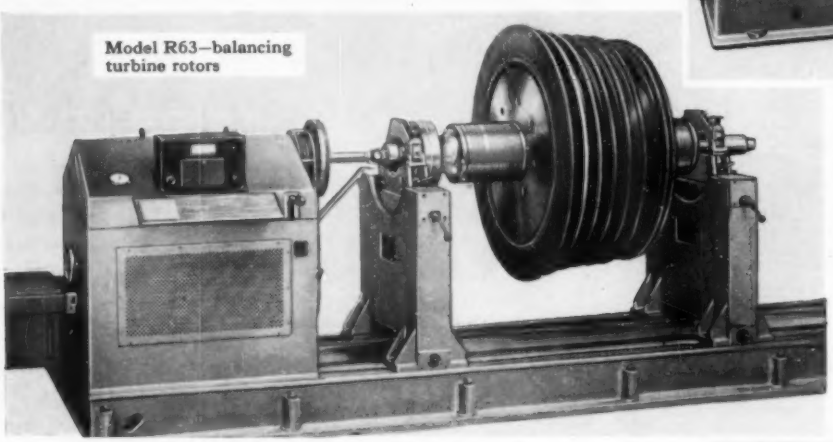
SCHENCK

ELECTRO-DYNAMIC BALANCING MACHINES

Now, in a fraction of a minute and in a single run, you can accurately determine the amount and location of dynamic and static unbalance on rotating parts. The SCHENCK Electro-Dynamic Balancing Machine has a sensitive and accurate electrical measuring system—without electronic tubes or oscillograph—that will indicate unbalances caused by displacements as little as 0.00004" from the center of gravity. Simple and easy to operate, the SCHENCK Balancer, by coordinate measurement, quickly indicates on a Wattmeter the unbalance of the rotating part.



Model R23—balancing floating armatures



Model R63—balancing turbine rotors

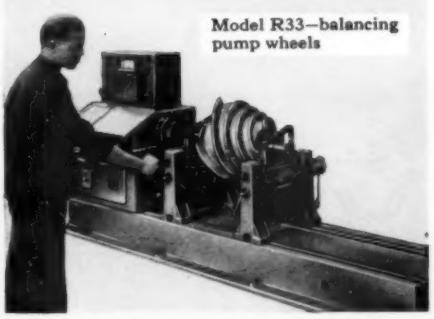
The workpiece is balanced easily by adding or removing weight units at two of the four balancing points located within the coordinates, 90 degrees apart. For many production installations, Schenck Balancers combined with machine tools—check, correct and inspect parts in one set-up.

SCHENCK ELECTRO-DYNAMIC BALANCING MACHINES ARE THE RESULT OF 40 YEARS WORLD-WIDE EXPERIENCE. THEY ARE MADE IN MANY CAPACITIES TO BALANCE ROTATING PARTS WEIGHING UP TO 100 TONS.

Machine Type	R13	R23	R33	R43	R53
Measuring Range (Weight of part in lbs.)	.1-22	.3-66	1-220	3-660	11-2,200

Machine Type	R63	R73	R83	R93
Measuring Range (Weight of part in lbs.)	33-6,600	110-22,000	330-66,000	1100-220,000

Let Cosa Engineers recommend the proper Schenck Balancer for your needs. Or, send for detailed catalog.



Model R33—balancing pump wheels

COSA — *nationwide sales and service of precision machine tools—from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

IN CANADA Contact COSA CORPORATION OF CANADA LTD., 1160 Lakeshore Road, Long Branch, Toronto 14, Ontario

$2,500,000 'Metal Cutting Laboratory' TESTS INGERSOLL INSERTED BLADE CUTTERS

Write today for new Ingersoll Cutter Catalog 66F, describing Ingersoll inserted blade face mills, end mills, helical slab mills, side mills, arbor cutters and boring heads.

Eight large mills and 19 knee-type machines, costing $2,500,000, are continually performance-testing Ingersoll cutters in regular production work at the Ingersoll plant, where we build some of the world's largest machine tools.

This ready-made metal-cutting laboratory is equipped with 600 different milling and boring cutters for work on cast iron, steel, aluminum, magnesium, copper, nickel and plastics. As much as 400 h.p. is available in a single milling spindle for cutter research and development.

These unique facilities are among the reasons why Ingersoll is especially qualified to recommend standard or special inserted blade cutting tools for all types of milling and boring machines.

THE INGERSOLL MILLING MACHINE COMPANY

ROCKFORD, ILLINOIS, U. S. A.

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES

ORIGINATORS OF SHEAR CLEAR CUTTERS

If **WEAR** *is a factor...*

...use VK CARBIDE PLUG GAGES

TUNGSTEN CARBIDE
wire type .016" to .500" diameter

TUNGSTEN CARBIDE
taper lock type .500" to 1.510" diameter

In addition to its regular line of tungsten carbide wire type plug gages from .016" to .500" diameter, The Van Keuren Co. now offers a new line of tungsten carbide taper lock plug gages in the range from .500" to 1.510" diameter.

Van Keuren tungsten carbide wire type gages have proved their worth on thousands of tough gaging jobs. The new tungsten carbide taper lock gages promise to be equally effective. They are offered in response to an insistant demand for T.C. gages in the taper lock range, and replace the chrome carbide gages previously offered.

Finish on VK gages in either the wire type of taper lock type in tungsten carbide will average .5 RMS or better. These gages are available in Class Y, X, XX and XXX accuracies at moderate prices and on a reasonable delivery basis.

Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

VK

37th YEAR

THE *Van Keuren* CO.,

174 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Laps and Surface Plates . . . Precision Lapping Service.

BUTTERFIELD

100% inspected for
100% performance

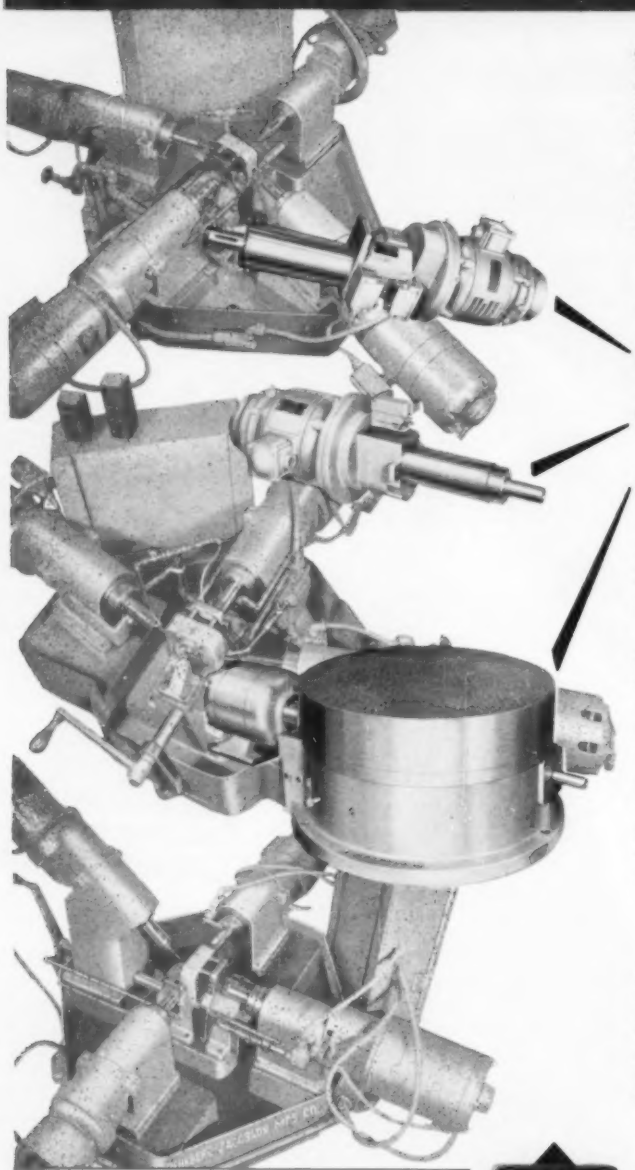
- they cut clean
- live long
- finish smooth

Use Your Local
Butterfield Distributor
To Your Advantage

You get lower inventory costs, expert counsel and "hurry-up" service.

UNION TWIST DRILL CO.
BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U. S. A.

MAKE YOUR OWN
SPECIAL PRODUCTION MACHINE TOOLS
WITH R-J UNITS



These Drill, Tap, and Index Units are so designed that they can be easily engineered into any simple and sturdy supporting structure. The Drill and Tap Units flange mount into straight bored holes, the Index Units bolt down to a flat surface. Our Data Sheets give complete dimensions, full specifications, and recommended capacities.

all-mechanical

DRILL UNITS

TAP UNITS

INDEX UNITS

All functions of R-J Units are fully mechanical, easily understood, and convenient for maintenance. They are completely reliable, as they have been integral parts of our special production machines for many years, and will continue to be. We make these units available as separate units, because we realize you have many occasions when you might want to add to an existing machine, make up a new multiple-operation job (such as the three little ones illustrated), or replace a unit to take care of engineering changes. All units meet JIC specifications (or can be provided with direct motor drive).

FREE BOOKLET

Write for this free "Manual" today. It contains data sheets and wiring diagrams of all Units. Also there are a score or more of reprints from advertisements, showing and describing typical R-J machines, and illustrating various methods of adapting the Units for various operations. Ask for the "R-J Unit Manual."

REHNBERG-JACOBSON
MANUFACTURING CO.
ROCKFORD, ILLINOIS

R-J

DESIGNERS, ENGINEERS
MANUFACTURERS AND
PRODUCTION CONSULTANTS

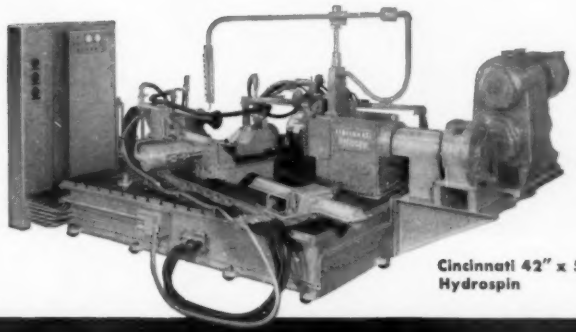
Why remove metal when you can move metal

31" long

into the shapes you want with the Cincinnati Hydrospin

14" high

A wide range of parts can be produced quickly and at low cost by "*chipless machining*" on the Cincinnati Hydrospin. Less metal is wasted and parts have accurate dimensions, high strength and good finish. Let a Process Machinery Division field engineer give you full details. For a description of the process and machine specifications, write for Bulletin M-1873-3.



Cincinnati 42" x 50" Hydrospin

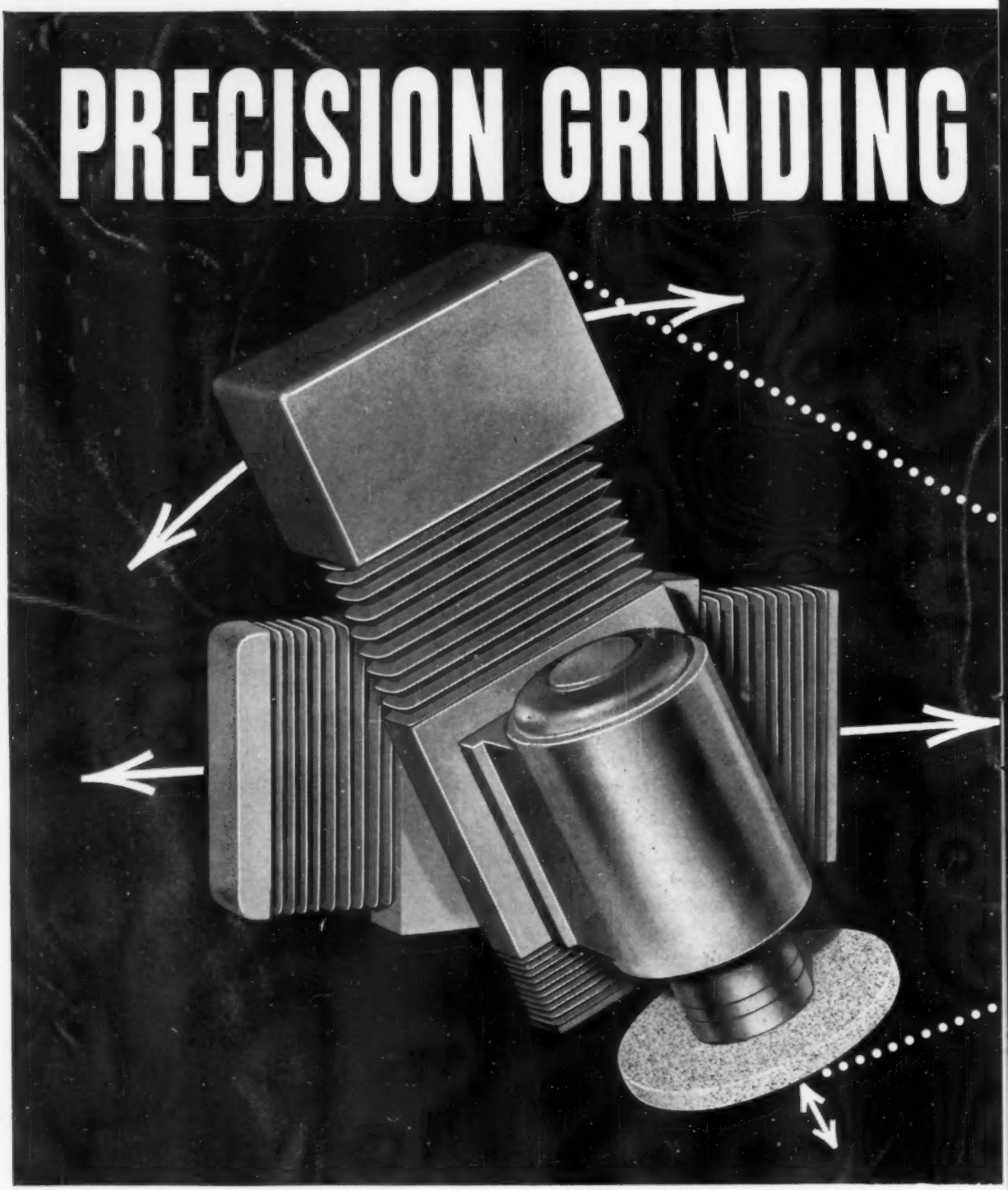
✱ Upper sequence of photos shows *one continuous* tube spinning operation. Starting blank, far left, of SAE 4130 is 8¾" long x 3" I.D. x 0.155" wall thickness. Finished part, shown at far right, Hydrospun in one pass, is 31" long x 3" I.D. with 0.030" wall thickness.

✱ Lower sequence of photos shows *one continuous* shear spinning operation. Starting blank, far left, is of type 302 stainless steel, 12" square x ¼" thick. Finished part, shown at far right, Hydrospun to a 32° included angle in one pass, is 14" high with 0.069" wall thickness.

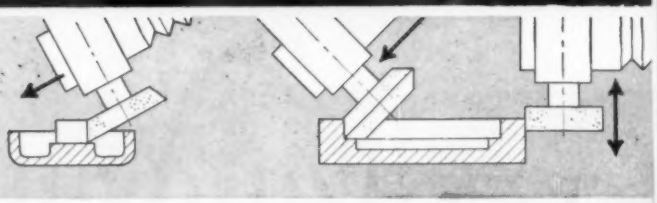
CINCINNATI **Hydrospin**

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

PRECISION GRINDING



Diagrams show typical applications of Frauenthal Standard Slide Units to a variety of grinding problems.



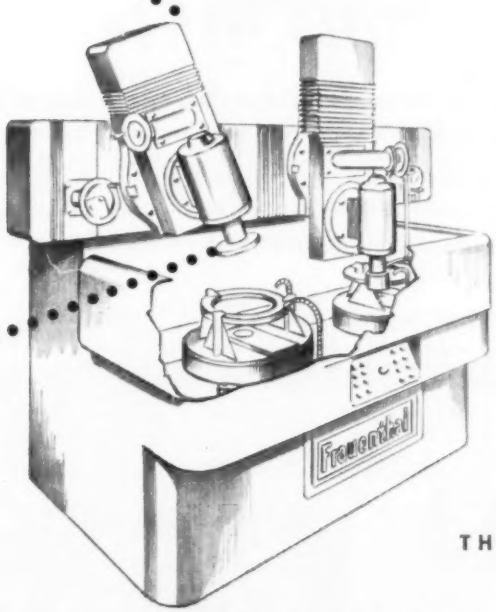
at any angle!

Frauenthal's creative engineering Now makes available Standard Slide Units in any number of combinations for production grinding applications . . .

IT IS NO LONGER NECESSARY to absorb special engineering and design costs when Frauenthal Standard Slide Units — plus a variety of grinding spindles — can be assembled to machine bases appropriate to a particular job. And these standard slides in single or multiple units can be arranged in a finite number of spindle positions to accommodate an endless variety of simultaneous or sequenced, automatically controlled grinding operations.

What's more, you get all the advantages of Frauenthal's advanced engineering and design experience—proven on single and multiple-head grinders used on special production jobs. For example: parts for jet engines, diesel and automobile engines, tanks, gun mounts, radar units, large and small diameter precision bearings and machine tool components.

As illustrated here, this model of the versatile grinding compound shows how the Frauenthal Standard Slide Unit can be adapted to approach the work from any desired angle.

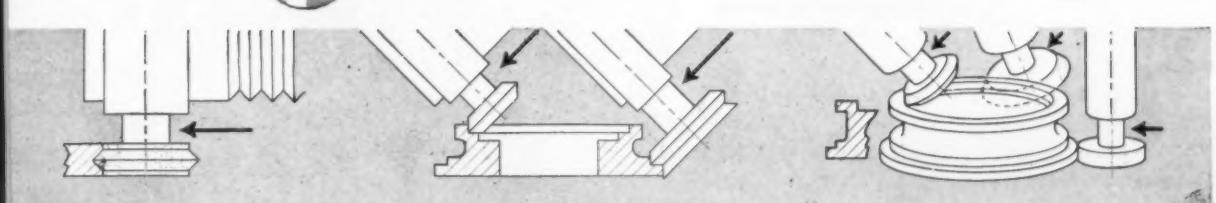


Here's a typical Frauenthal Double Head Vertical Spindle application utilizing two of the Frauenthal Standard Slide Units shown on the opposite page. Although applied to a particular grinding situation, these slide units retain versatility for angular positioning. Frequently, as indicated in panels 2 and 4 at the bottom of the page, diameters and adjacent surfaces are ground at one time with a single wheel dressed to the proper contour.

Send a print of your "problem grinding part" and our engineers will show you how to apply Frauenthal Standard Slide Units to solve the problem. Include in your letter pertinent production information — number of pieces, etc. Be sure to investigate the latest Frauenthal Vertical Grinders with Standard Slide Units. For complete details, contact Frauenthal of Muskegon.

Frauenthal Division
THE KAYDON ENGINEERING CORP.
MUSKEGON, MICHIGAN, U. S. A.

F-256



here's the Super carbide drill for your job

STC

any quantity . . . . any style

As the biggest producer of carbide drills, we are able to offer a specific type for every carbide drilling application.

Exclusive features incorporated in these drills give greater tool life, faster cutting at lower cost.

High volume production facilities make tools available from stock.

Standards stocked in fractional, wire and letter sizes, in solid and tipped carbide; types for hardened steels, cast iron, aluminum, magnesium, plastics and abrasive substances.

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Super TOOL COMPANY

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WAREHOUSES: CHICAGO • DETROIT • NEW YORK • LOS ANGELES

carbide NEWS

Another WESSON development eliminates grinding, makes tool changes quick and easy

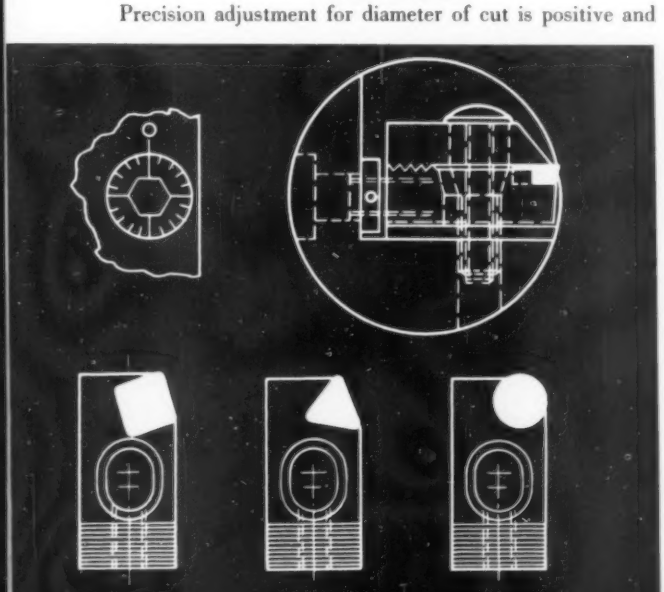
New Precision Boring Tools Use Throw-Away Carbide Inserts

Micro-adjustable boring tools using "throw-away" carbide inserts are the latest in a series of developments pioneered by Wesson in recent months. Aside from eliminating grinding and speeding tool changing and setup, considerable improvement in performance and lower tool cost per piece are major advantages reported from the development.

On the Button

Precision adjustment for diameter of cut is positive and simple. It can be made without removing the tool from the machine since the new Wesson boring tools incorporate a calibrated screw adjustment. The circular dial has 25 graduations, each representing .001-inch. Thus each revolution of the screw is equal to moving the tip in or out .025-inch. Accuracy is assured since the head of the adjusting screw is always pulled up and locked positively against a locating face.

Among striking features is an adjustable built-in chip breaker that also serves as the clamp for the tip.



Versatility Too

Round, square or triangular inserts can be used with only minor parts changes. All parts of any one size of boring tool are identical except for the tip and the anvil-locator in which the tip is mounted.

The new tools are also suitable for internal (American Standard) threading operations using standard Wesson-metal 60° triangular inserts.

For more information on Wesson's micro-adjustable boring tools, write for Data Sheet 8156, or contact your Wesson tool engineer.

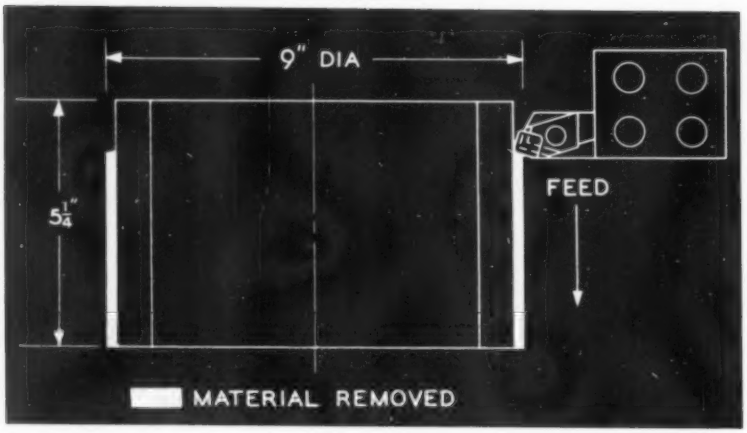
◀ *Calibrated-screw (upper left) enables precision adjustment in size of hole being bored to be made right in the machine. Note standardization of parts for interchangeability.*

carbide NEWS

Automation Boosts Demand for Special Tools

While automation tends to increase standardization of products, it works the other way when it comes to the tooling used in automated lines. So much so, in fact, that Wesson Multicut Company is erecting a new plant in Brighton, Michigan, just to take care of the skyrocketing demand for its special tools in automated industries. No standard tools will be produced at the new plant. The Multicut plant, shown in the architect's drawing, is the fourth Wesson expansion in the past two years. Previous expansion moves included the new Wesson Metal plant in Lexington, Kentucky, a new Wesson Research Center in Detroit and the new Wesson Cutting Tools, Ltd., plant in Toronto, Canada.

General Purpose Grade Beats Specials on Tough Job



Tough machining jobs don't necessarily call for special carbide grades. Often a general purpose grade will do an even better job. Here is a case in point. The job shown above, was turning the OD of a steel coupling that was unusually tough and scaly. The forgings (low-carbon chrome-moly-vanadium) also had considerable warpage.

Depth of cut, as a result, varied from .070 to .180 inches. This, with all that scale too, caused enough tool breakage to keep output down to around 24 pieces per tool (4 per grind) even though specialized grades were used.

The job was re-tooled with a Wesson Multicut holder using throw-away carbide insert of WESSONMETAL 26—a broad range general purpose steel cutting grade. Output jumped to 100 pieces per cutting edge (800 per insert) with no grinding required.

Tool cost dropped from 48 cents per piece to only 1.4 mills each. In addition, output doubled since WESSONMETAL 26 made it possible to step up both feed and speed on the Gisholt lathe in addition to reducing tool-change downtime.

tools Wesson carbide Wessonmetal

WESSON COMPANY DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 LEICESTER AVE., TORONTO 18, ONTARIO

COST CUTTING IDEAS PROVED IN OTHER SHOPS . . . Have you tried them?

When throw-away inserts are worn on all corners usable for turning, don't throw them away yet. In many operations, it is only the corner that really wears very much, leaving the rest of the insert as good as new. Switch it to a chamfering or facing operation.

• • •

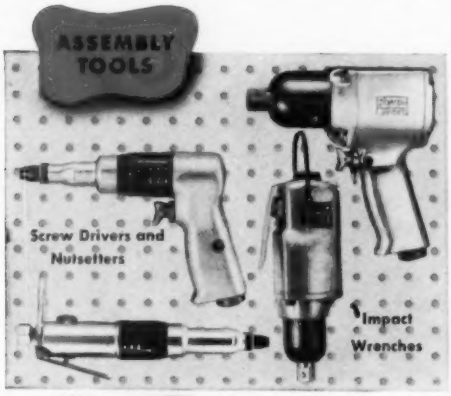
When a part print comes from engineering with drill holes that have a high length to diameter ratio, see whether that ratio can't be reduced. If the ratio is cut in half you may be able to cut tool costs 80%. Tool costs go up much faster than depth of hole if diameter stays the same.

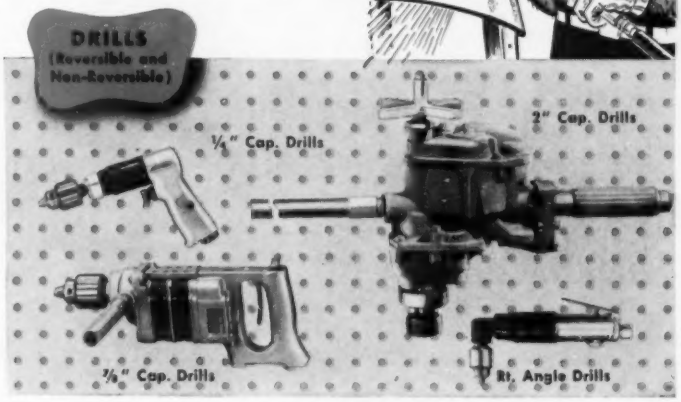
• • •

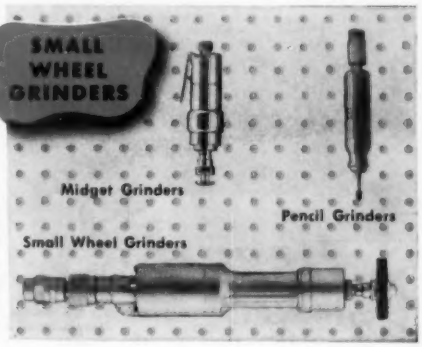
Don't assume that you've done a job on tool costs when you've cut the cost in half on a particular operation. Wesson engineers, time and again, have been able to help cut costs still further by on-the-job, in-the-shop engineering application.

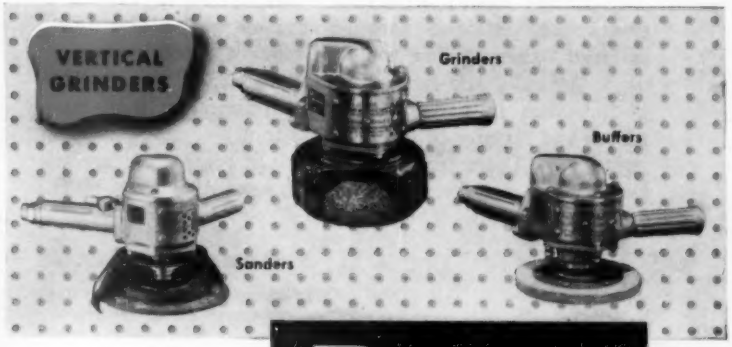
What's your portable tool problem?

THERE'S A POWERFUL ROTOR TOOL TO DO IT *FASTER!*









● Write for Bulletin 53 giving specifications on complete line of Rotor Tools for all industry. The ROTOR TOOL Company, Cleveland 32, Ohio.

ROTOR TOOLS
CLEVELAND, OHIO

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

1000
~~400~~ sfpm

depth of cut-.125 ~~.005~~

1250
sfpm-~~800~~

~~"unmachinable"~~

2000
~~250~~ sfpm

~~65~~
pieces per hr.-~~20~~

1175
SAE 1035-~~250~~ sfpm

~~505~~
HS-Steel-~~90~~ sfpm

4
min. per cut-~~40~~

you can scrap your ideas of cutting-tool performance . . .

STUPALOX

introduces a NEW ERA!

The figures above show the amazing improvements in production obtained through the use of STUPALOX sintered oxide cutting tools in place of tools previously used. Actually the figures are conservative, because tool performance in many cases was limited by inadequate power and rigidity of the machine tool.

Stupalox Tools are available now in commercial quantities, and a variety of styles and sizes of inserts. Write for complete data.

HANDY PACKAGE — *contains ten inserts*

This compact plastic box provides a practical container for ten Stupalox sintered oxide inserts.

Stupakoff
DIVISION OF
The CARBORUNDUM Company

Write Dept. TE
LATROBE,
PENNSYLVANIA

Want to net big grinding savings? Let Peninsular analyze your jobs

Grinding savings of both time and money often are hidden in unsuspected places. Peninsular Abrasive Engineers can quickly flush them into the open by making a comprehensive analysis of your complete operation. Their reports already have netted thousands of dollars a year for plants across the country.

For example, a semiautomatic machine stood idle for redressing after pointing only 8-10 high-speed drills. When Peninsular engineered a new wheel, production soared 400%, to 45-50 pieces between dressings, drastically cutting expensive downtime. In addition, wheel life increased 20%.

Call, write, or wire us today.

Vitrified and Resinoid Grinding Wheels

PENINSULAR

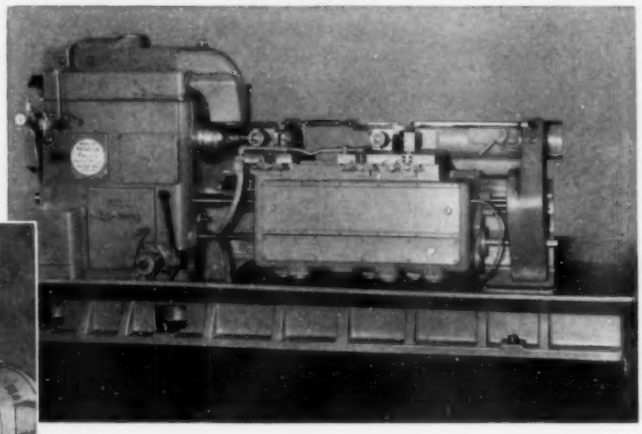
GRINDING WHEELS

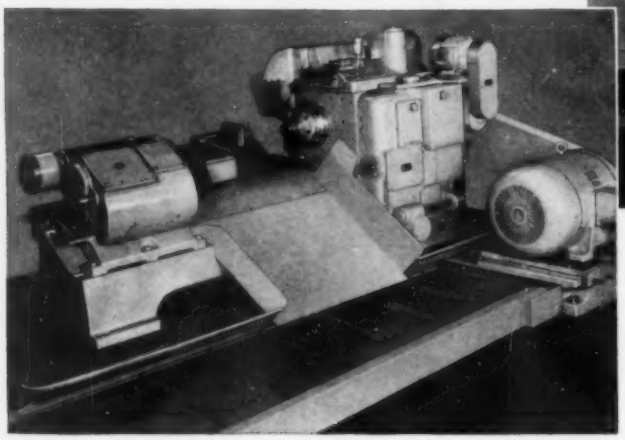
PENINSULAR GRINDING WHEEL DIVISION—ABRASIVE AND METAL PRODUCTS COMPANY—DETROIT, MICHIGAN

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK

NEW SENECA FALLS DESIGN SOLVES CHIP DISPOSAL PROBLEM





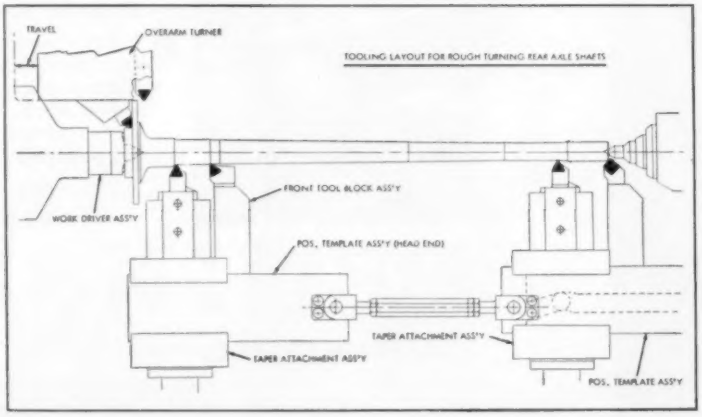
PROBLEM: To eliminate machine down time due to chip accumulation in the tooling area and pan of lathes required for a high production rear axle shaft job.

SOLUTION: To promote rapid flow of chips from the edges of the cutting tools, Seneca Falls engineers designed a special "Chip Flow" type bed for the otherwise standard Model AR Automatic Lo-swing Lathe.

The rear view illustration shows that the usual back shelf has been eliminated in the chip area and replaced with a smooth, steep angle slope which assures an uninterrupted flow of chips from the edges of the cutting tools into the mechanized chip conveyor at the base of the machine. Auxiliary attachments are mounted overhead instead of on the usual back shelf. An auxiliary, cam-operated turning slide mounted on the headstock is used for turning the outside and pilot diameters of the shafts. Facing slides can be supplied to replace this attachment.

High spind¹e speeds and coarse turning feeds assure a production of 153 shafts per hour with Automatic Work Handling Equipment.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.



PROFIT ENGINEERED BY SENECA FALLS

Here's help in

ORDERING HYDRAULIC VALVES!

Use the form below to get specific information, prices, circuit designs and other data you may need on hydraulic valves.

Rivett catalogs 190 standard models in all popular sizes, types, actions, piston designs and pressures. Nearly any hydraulic valve requirement you may possibly have can be filled by Rivett. And Rivett's Factory Engineers and experienced Sales Representatives will assist in planning the most efficient circuits for your operations.

We are interested in the Hydraulic Valves checked below.

☐ Send complete literature, specifications, and circuit information. ☐ Send quotations on items checked. ☐ Have our Rivett Representative call and supply circuit information. ☐ Our specific hydraulic problem is:_____

_____

_____

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- Operation:
  - ☐ Threaded Stem
  - ☐ Lever
  - ☐ Knob
- Action:
  - ☐ Manual
  - ☐ Spring
  - ☐ Ball Detent

☐ Cam

☐ Foot

☐ Direct Solenoid Operated
- Mounting:
  - ☐ Pipe
  - ☐ Sub-Plate
- ☐ Double Solenoid No Spring
- ☐ Single Solenoid Spring Return
- ☐ Double Solenoid Spring Centered

☐ Solenoid Pilot Operated
- Mounting:
  - ☐ Pipe
  - ☐ Sub-Plate
- ☐ Double Solenoid No Spring
- ☐ Single Solenoid Spring Return
- ☐ Double Solenoid Spring Centered

☐ Oil Pressure Operated
- ☐ No Spring
- ☐ Spring Return
- ☐ Ball Detent
- ☐ Spring Centered

☐ Air Pressure Operated
- ☐ No Spring
- ☐ Spring Return
- ☐ Spring Centered

☐ Oil Pilot
- Mounting:
  - ☐ Pipe Line
  - ☐ Base
  - ☐ Foot
  - ☐ Panel

☐ Flow Control

☐ Check
- Mounting:
  - ☐ Pipe
  - ☐ Flange
- ☐ Spring Loaded
- ☐ Pilot Operated
- ☐ Pilot Operated with Pressure Breaker

☐ Shut Off

☐ Deceleration

☐ Relief

☐ Unloading

☐ Sequence
- ☐ Direct Operated
- ☐ Remote Operated
- ☐ With Integral Check

☐ Counter-Balance

Sizes
☐ ¼, ☐ ⅜, ☐ ½, ☐ ¾, ☐ 1, ☐ 1¼, ☐ 1½

Pressures
☐ 1500 P.S.I. ☐ 3000 P.S.I.

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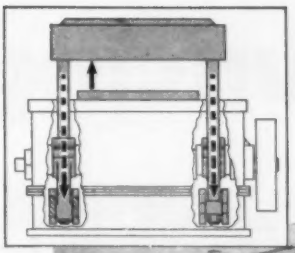

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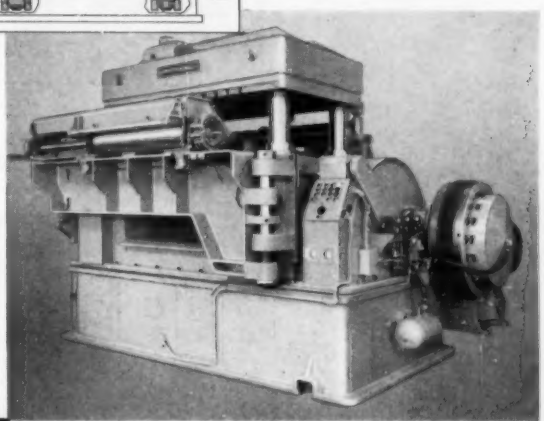

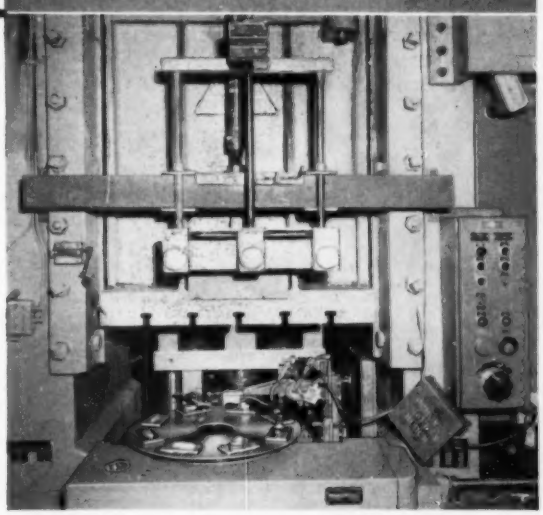

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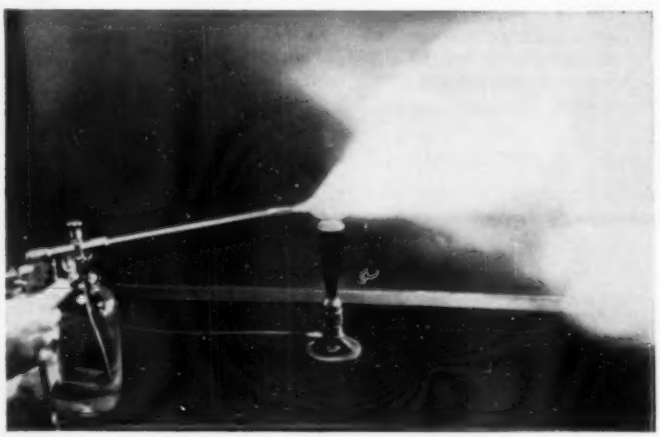
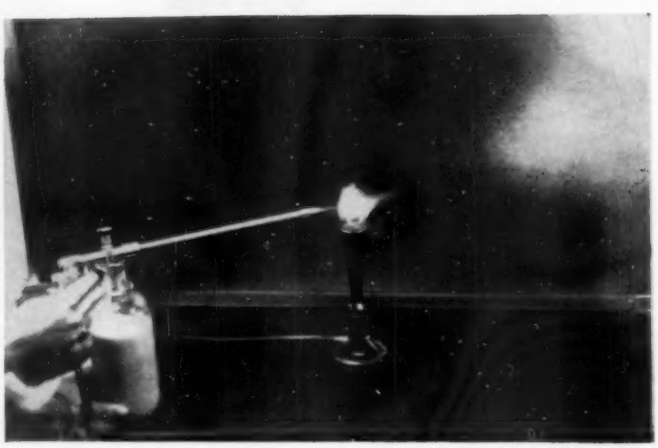


This photo shows the instant combustion taking place when a conventional hydraulic oil of mineral oil type is atomized over a Bunsen burner.



In this photo, Shell Irus Fluid 902 replaces the mineral oil. Note that there is no ignition.

SHELL IRUS FLUID 902

Oil-Base fire-resistant FLUID

SHELL IRUS FLUID 902

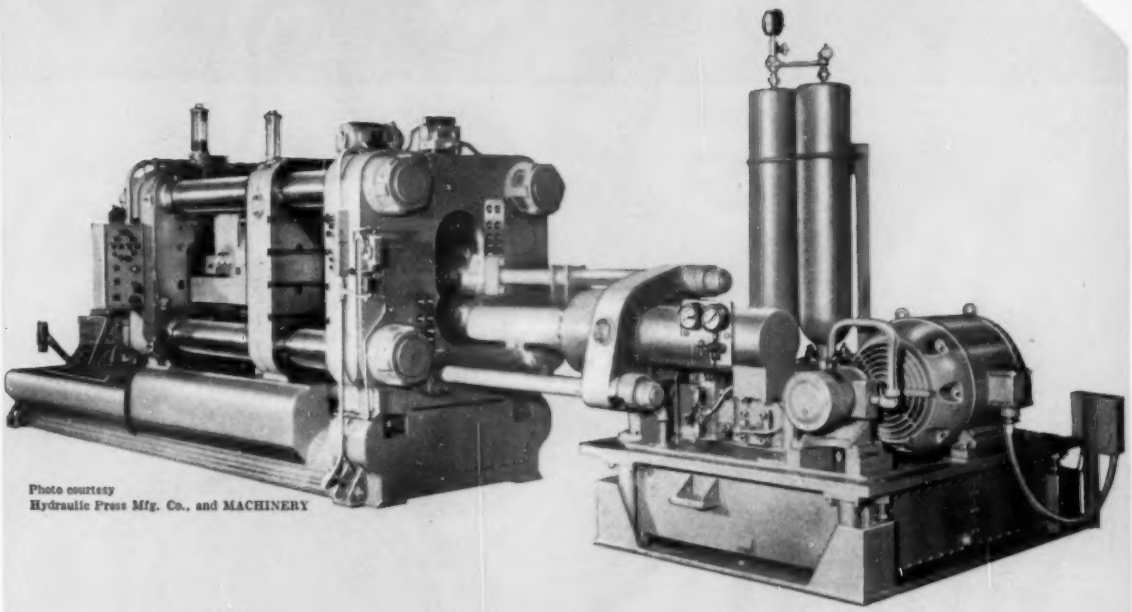


Photo courtesy
Hydraulic Press Mfg. Co., and MACHINERY

AFTER THREE YEARS of intensive research, field application and evaluation, Shell Irus Fluid 902 is now commercially available for use in industrial hydraulic systems. While its cost is far lower than other fire-resistant fluids, its performance is comparable.

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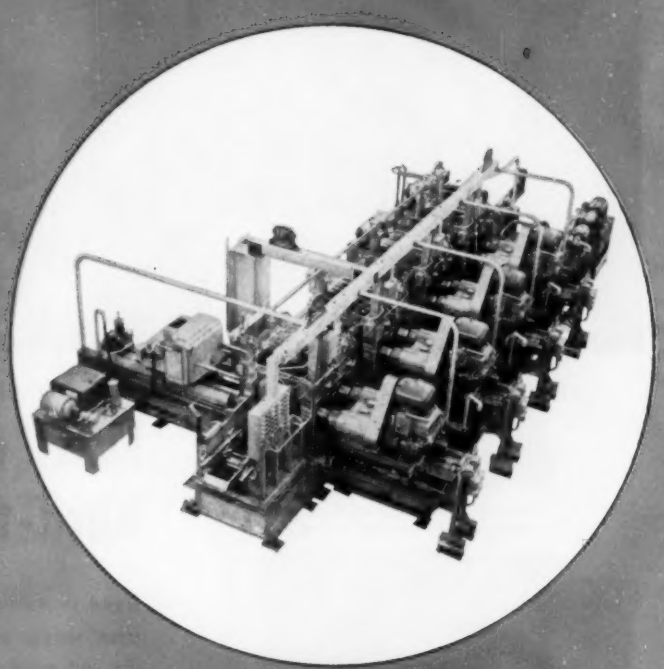

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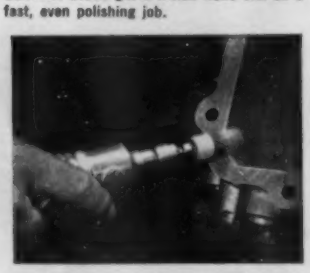

ABRASIVE PENCILS produce a neat radius on inside flanges and edges like this one.

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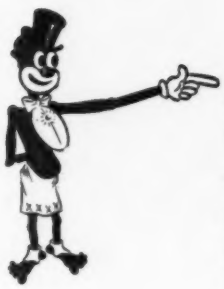

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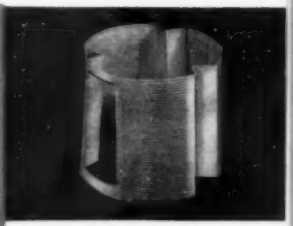
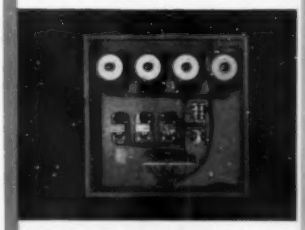
If there is a place for one of "Speedy's" energetic and thoughtful brothers in your manufacturing plans, call on a Clearing sales engineer to talk the problem over.



Hotpoint dryer basket after it has been perforated and rolled into its cylindrical shape.



Part of the electronic brain that tells "Speedy" when to start and stop and where to locate the perforations.

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The Tool Engineer

Treasury of Experiences

Everyone has a treasury of experiences. Such a treasury has a terrific value for it does not diminish when drawn upon or shared. Every new experience adds to its sum total.

Engineers are always alert to add to their technical and scientific experience. A wise engineer will also accept leadership responsibilities to add a valuable experience to his treasury. Engineers with leadership ability are in great demand.

Your ASTE chapter offers many leadership opportunities. This month, the chapters begin the year's activities in earnest. Go to the chapter chairman and offer your services. Many tool engineers have had significant advancements in their companies due to experience gained in chapter operation.

Do not hold back because you feel that you are not well qualified. Remember that many of the better chapter chairmen were timid beginners on a chapter committee only a few years ago.

Put your shoulder to the chapter wheel and have the personal satisfaction of contributing to its successful operation. You will also be adding a real asset to your treasury of experiences.

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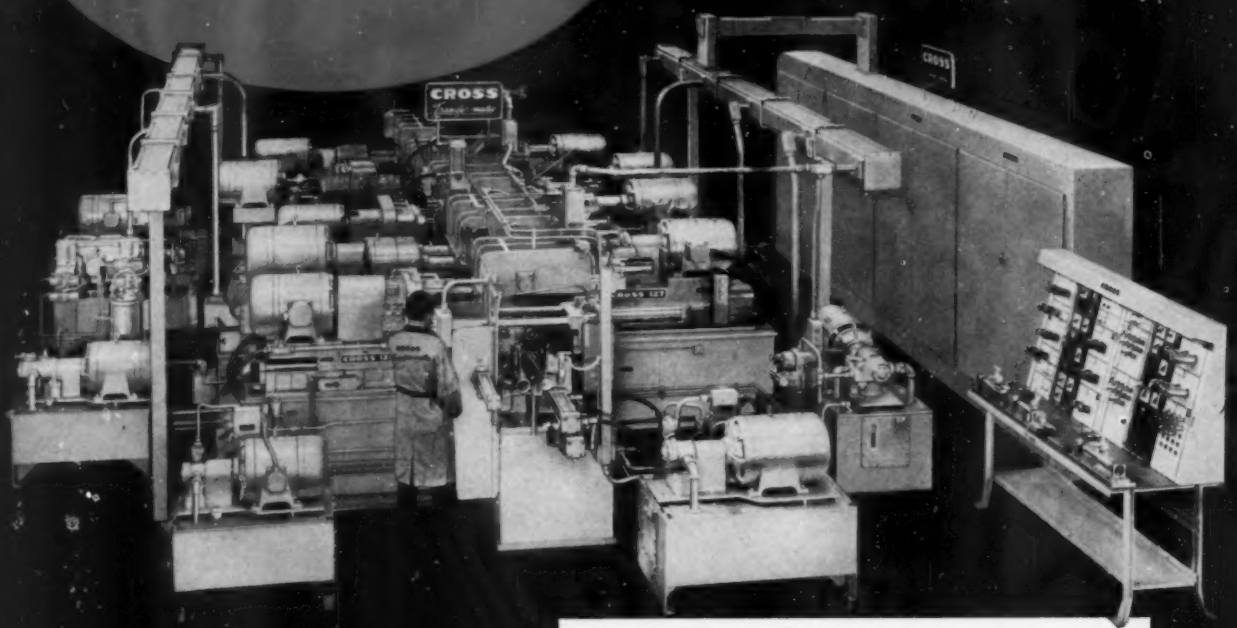

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Modernization begins at home

By Walter K. Bailey, Pres.*
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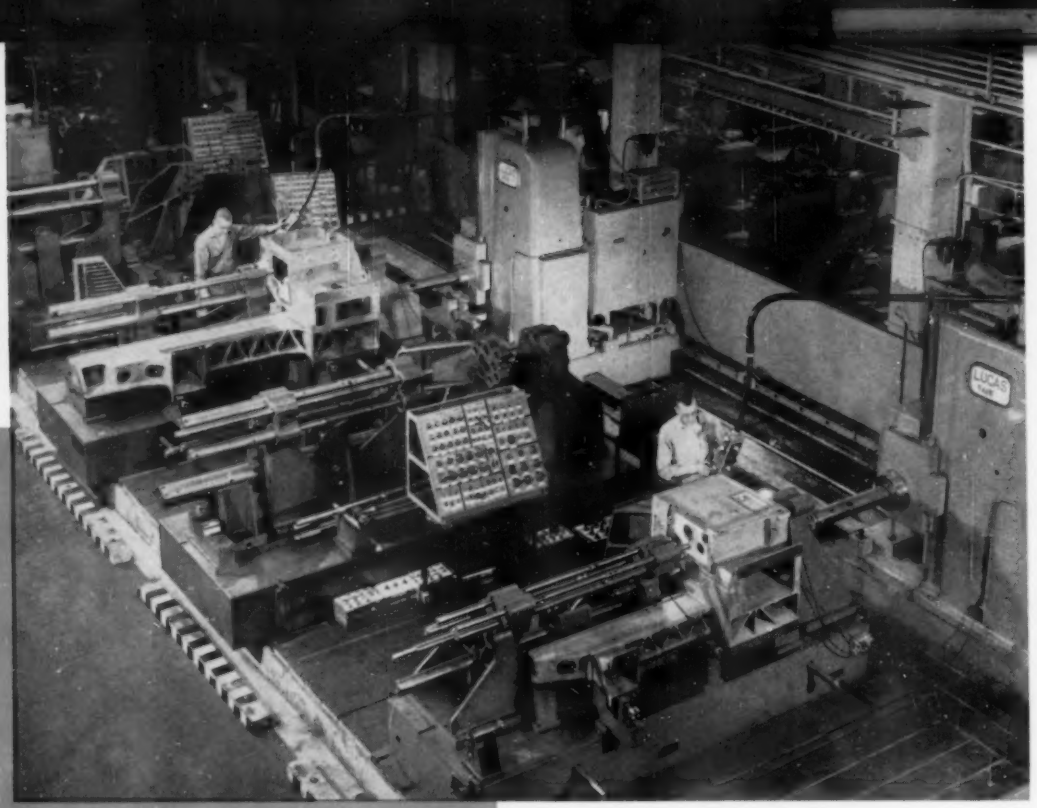
How to sell management on the necessity of modernizing facilities poses a continual problem for tool engineers concerned with production efficiency. Based on a talk given before the Cincinnati chapter, this article provides some forthright answers as well as a practical basis for them.

TOOL ENGINEERS are always in the center of modernization programs. No modernization—no tool engineers. They are always in the middle; between the lack of money to correct the old and the demand for money to produce the new; between the pressure to reduce existing costs and the requirements of planning for new items.

*Senior member ASTE Cleveland Chapter

The need for business management to increase production and lower costs should apply at least equally to the items that are now being produced as well as items of new design that are about to be placed on the market. When the question arises, it's the new item that wins out. Of more importance are costs of the present items of production, the costs of the items that make up the biggest part of the volume of business and, incidentally, the items which produce most current profits and will produce most future profits.

To see how important this idea of producing better, faster, and for less requires only one statistic. By 1965 this country will have 20 percent more people and only 14 percent more workers. This means that unless productivity is steadily increased, which means lowering costs in terms of labor hours, present standard of living cannot be maintained. The standard of living is determined by what is produced. To maintain and improve the standard of living, the gap between the 14 percent more workers and the 20 percent more people must be



Modernization of boring mill department provides tool boards which reduce setup time 50 to 60 hours per month, in addition to other advantages.

closed. Otherwise, these circumstances will force working more hours per week in order to produce the same amount of goods for the increased population.

So it will not be enough to bring out new items to add to the standard of living and produce them at low cost. It will also be necessary to concentrate on the old items. It is up to management to see that a larger proportion of the tool engineers' time is concentrated on this problem.

How can an atmosphere be attained that permits calm and careful consideration and action on things that should be done on modernization of existing equipment? How does one get action on things that are obvious but that take money? Everyone believes he will be in business 5 to 10 years from now; then why not modernize now? Certainly, those in the equipment business don't believe that it can be done for less investment at a later date. Nearly everyone knows and believes that equipment will cost more in the future rather than less.

Then, how is it possible to get capital outlay now, when it will take less than 2 or 3 years from now. How is it possible to take advantage of the productivity of the new equipment, which will partially pay for the equipment during the next few years? In order to get modernization under way in an individual plant, management needs to recognize a few principles and establish a few policies and then see that these policies are put into practice.

One of the first things that should be recognized is that each dollar spent in day-to-day operations is just as important and affects earnings just as much as any other dollar. During any day's operation, the dollar that is spent operating a small drill press or a factory truck or sweeping the floor is just as important as a dollar spent on a punch press or another large volume production machine. Also, the dollar spent on the old line of products affects the balance sheet as much as a dollar spent on a new product.

Next, management must always remember that replacement and replacement policy is a function of management and not a function of accounting and engineering. Many times management knows that things must be done to preserve, protect and expand the business which do not appear to be justified from a strict accounting basis. Accounting deals with facts only and facts are always in the past.

This does not mean that management should ignore the aid that can be obtained from accounting and engineering figures and from formulas, to the extent that such figures provide data upon which management can base its judgment. They are of great value, but there are many times when management must make decisions upon broad judgment based on assumptions as well as facts. Judgment deals with the future as well as the past.

Closely connected with the foregoing, it is essential that management place as much confidence in the judgment of engineers and operating men, when

considering replacement and modernization, as they do when they are considering capital expenditures for new projects.

Management, having once decided upon a new project, almost completely relies upon engineers for the decisions as to what should be done to accomplish this new project. In general, management, and particularly financial management, fails to place this same confidence upon the opinions and judgment of the staff when a question of replacement of equipment is involved.

Any organization will have in it people with sufficient experience and sufficient judgment to give equally sound recommendations with regard to replacement. When such replacement is a perfectly obvious necessity on the part of the producing people, it should not be necessary for them to assemble the complete data in order to prove, on an accounting basis, that the equipment should be purchased. Doesn't it seem odd that management will give lip-service to the fear that their equipment is becoming old and obsolete, but that they refuse to act upon the recommendations of the people who are operating that equipment.

Suppose the president of a company is told by the shop superintendent that some of the equipment in department B is obsolete. Should he then call in the head of his financial department and say to him, "Will you please apply the MAPI formula to the equipment in department B and see what needs to be replaced?" That's the wrong way to go about it, because accountants, no matter how good they may be in their field, are not production men. The place to start is within department B.

If the operator of machine No. 30 in that department says that he could turn out twice as much per hour on a new machine; if the foreman of the department says, "Machine No. 30 is our bottleneck;" if the shop superintendent says, "That's the machine causing the worries;" and on top of that the machine has lost its accuracy to such an extent that it can only rough-finish work and another machine has to be used to get the tolerances required, it is plain, without consulting an accountant, that machine No. 30 ought to be replaced.

If at that point confirmation is wanted to reduce the proposition to a dollars-and-cents basis for budgetary reasons, then it is a good idea to call in the accounting department. Let them apply the MAPI formula to the replacement of machine No. 30

Turret lathe department before modernization.

Turret lathe department after modernization has adequate lighting and other facilities for operator comfort in addition to improved production equipment.

Milling department after modernization exemplifies well-lighted, orderly and clean work area.

by a new machine. But don't use that or any formula to delay its purchase.

This is not condemning formulas as such. But the point is that, in most cases, they are unnecessary. There is one great advantage to the formula approach. It can be used to stimulate thinking about replacement. The MAPI formula in particular has a great advantage in that it necessitates the investigation of many cost factors which often are not given proper consideration. In addition, it reduces these factors to a dollar-and-cents basis and it forces the estimating of savings in the future upon the basis of assumptions.

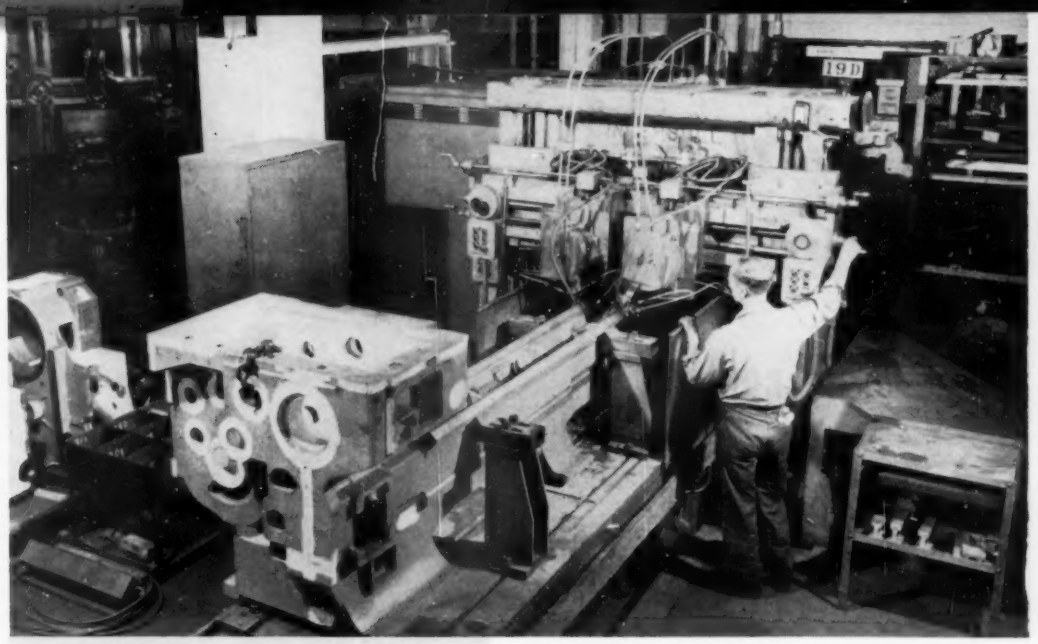
By going through the plant on this basis and by listening carefully to people engaged in production, it is easy to determine which machines are most urgently in need of replacement. The question then is, how fast to replace and which ones should be replaced first. There will be problems of money and time. Decisions must be made within annual budget limits as to which replacements have priority. So out of all that develops not only a replacement program, but also a replacement schedule.

Working out such a method is of the utmost importance so that management can recognize that day-by-day failure to modernize will make modernization much more difficult and expensive in the future. Replacement arithmetic developed to cover the case of a machine under consideration for replacement will help give recognition to the fact that the continued operation of a machine or a method, which is not the best machine or method from a cost standpoint, represents a cost which often is far greater than the amount of capital outlay required to correct the situation.

Furthermore, it is necessary that management take a realistic view with regard to depreciation, depreciation reserves, and their effect on the future of the business as well as their effect on the current balance sheet. First it is necessary that management recognizes that the cash capital retained in the business as a result of depreciation reserves or accounts should be used for the purpose of replacing or modernizing plant and equipment. This cash, which is preserved in the business as a result of depreciation, cannot be diverted into procuring added facilities for increased production, cannot be used for increasing inventory or to cover the increased cost of inventory. It cannot be used to offset increasing accounts receivable without creating an impossible situation in the future with regard to capital equipment replacement.

This is no recommendation for changes in depreciation reserves or accounts, such as changing to the now permissible methods of faster depreciation. Such changes may be of great advantage but, where is the advantage of faster depreciation or amortization, if a sound policy of modernization is followed with regard to plant equipment? It makes little difference whether a piece of equipment is written off quickly or slowly if, when it should be replaced, it is replaced promptly and the old equipment liquidated.

On the other hand, if fast amortization or fast depreciation is taken and the equipment is not replaced or modernized when it should be, then all



Induction hardening of turret lathe beds is a clean and accurately controlled method that is economically justified.

that is accomplished is to retain a certain amount of cash in the business at a period when the equipment is new. If this cash is absorbed for other purposes, the cash will not be available when replacement is needed.

This is somewhat the situation with regard to the fast amortization that practically all machine tool builders took during World War II and during Korea. The cash that was kept in the business at that time is no longer in the form of cash available for replacement of World War II equipment.

The point is, cash kept in the business as a result of depreciation should be available for the purchase of replacement equipment. For instance, last year, a company had a depreciation and fast amortization charge against operations of approximately $2 million. Some of this charge came as a result of normal and accelerated depreciation, some as a result of fast amortization and some as a result of the sale of assets which had not been fully depreciated until they were sold. If on the other hand, depreciation charge had been $1 million instead of $2 million, there would have been two rather important results. First, of course, the accountants would point out that the figures would have shown an operating profit before taxes of $1 million greater than shown. There would have been an increased net operating profit of approximately $480,000 more. This creates an important statistic because the statement would have shown that the company made approximately 60c per share more profit in the year of 1955.

The creation of this $1 million more profit before taxes would have resulted in payment of $520,000 in cash to the government so that at the end of the year, there would have been $480,000 less cash available for operations. Forgetting the figures in the balance sheet for a moment, one can see that with exactly the same physical assets, there would have been $520,000 less in cash.

Actually, because the depreciation reserves were approximately $2 million, and because the company spent an amount equal to this, that $520,000 was transferred into new machine tools and assets.

From a practical standpoint, it is important that almost all depreciated assets can be sold for more cash than their book value. This is particularly true in selling assets, especially machine tools purchased between 1935 and 1945. The additional cash received, over and above the book value, goes a long way toward the purchase of a new machine when it is added to depreciation reserves.

Why get into such a subject, which most engineers think belongs in the financial departments? Simply because lack of true appreciation of the significance of these things handicaps engineers in getting their managements to do what they know they should do for the future benefit of the company. Management must recognize that, in trying to overcome the financial problems resulting from inflation, their need for additional capital in their business must not be taken from the machinery and tool account.

One of the things which is preventing many businesses from modernizing is the fact that they do not place the same confidence in the opinions of their manufacturing personnel as they do in the opinions of their sales, design, advertising and financial personnel. It is a challenge to tool engineers to earn the confidence of management. Together they can attack the problem of modernization—something both recognize as essential to profitable operation.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

GADGETS CONTEST!

Cash prizes will be awarded for the best "Gadgets" submitted by ASTE members. Contest is open now, and will run through December 31. See ASTE News for full details.

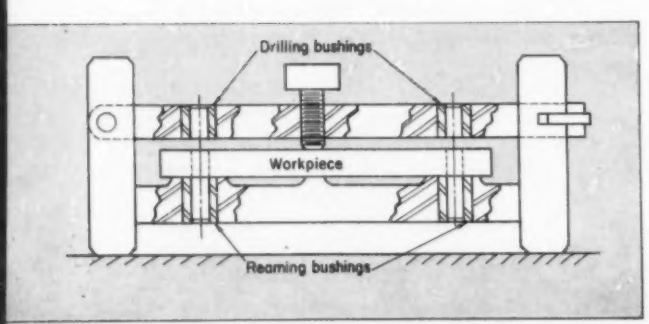
Dual-Purpose Drill Jig

Conventional jigs for drilling and reaming operations are provided with liners and slip drill bushings. After drilling, the bushings are removed and replaced with larger hole diameter bushings for reaming. This removal and replacement of bushings takes considerable time and effort, particularly when jigs with large numbers of bushings are used.

The dual-purpose jig illustrated eliminates the need for continually changing drilling and reaming bushings. The bushing holes are drilled through both the top and bottom plates of the jig. Drilling bushings are inserted in the top plate and reaming bushings in the bottom plate. Instead of changing drill bushings after drilling, the fixture is turned over for the reaming operation.

An added advantage is the lower original cost of press fit bushings as compared to the cost of liners and slip bushings.

H. J. Gerber
Member-at-Large
Stillwater, Okla.



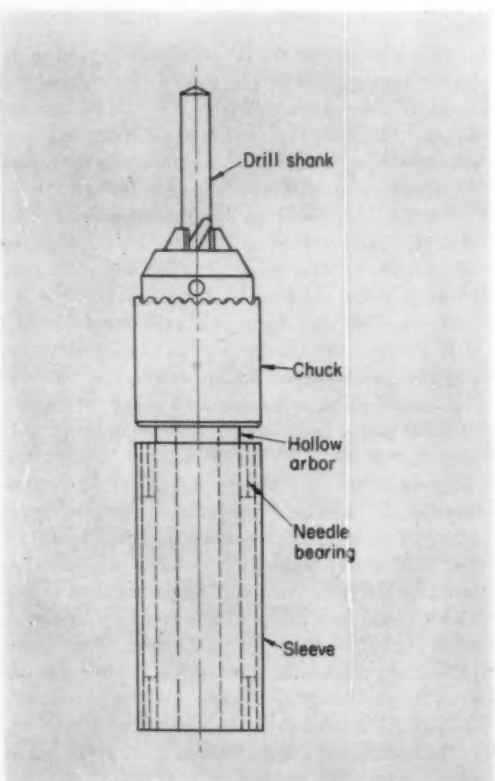
Drill Shank Grinding Fixture

Tools used in portable electric drills for assembly work are subjected to a considerable amount of twisting and side pressure. As a result it is not uncommon for the drill shank to slip in the chuck, resulting in heavy scoring and raising burrs.

Reconditioning of such tools can be simplified through the use of the hand-held fixture illustrated. The fixture consists of a drill chuck mounted on a large diameter hollow arbor which rotates on needle bearings inside a sleeve.

Grinding is accomplished by mounting the drill in the chuck and running the shank across a wheel at such an angle that it spins as it is being ground. This quickly cleans up the shank and insures that it is round and concentric.

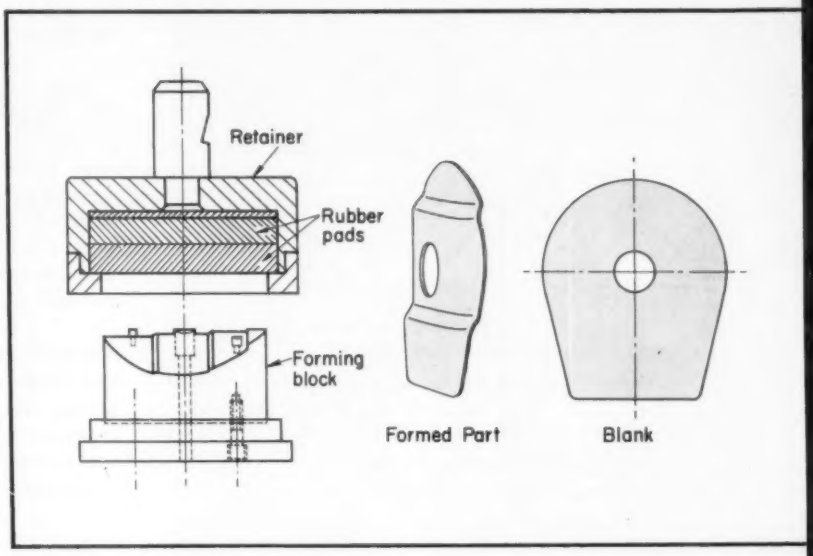
Henry Koslow
Bronx, N. Y.



Rubber-Pad Die

Low-cost forming of a small brass nameplate after painting was made possible by the use of a rubber-pad die. The die consists of a steel forming block, shaped to the contours of the nameplate, and rubber pressure pads mounted in a retainer which is fastened to the ram of the press. The radius of the contour of the forming block is made slightly smaller than the radius of the part to allow for springback. Four gage pins in the block position the blank for the forming operation.

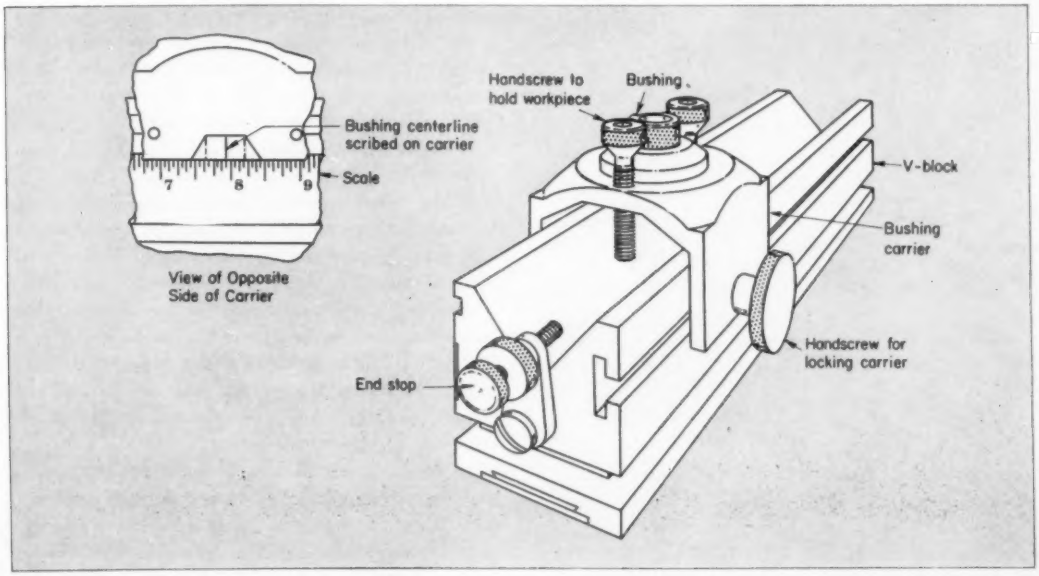
Paul Forberger
Sao Paulo, Brazil

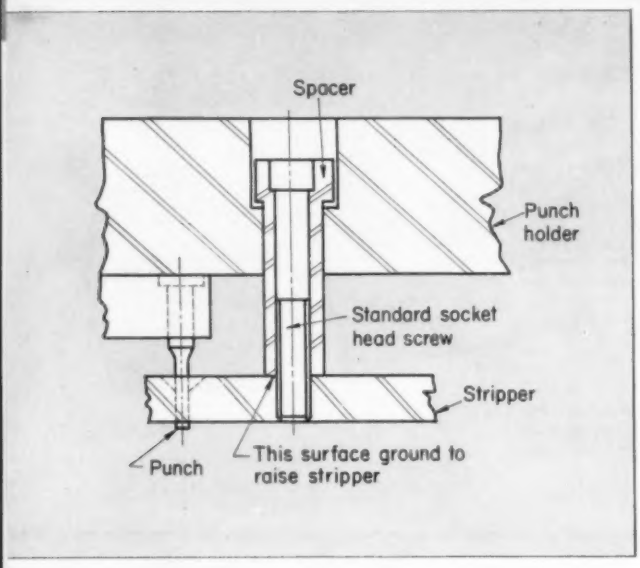


Universal Drill Jig

Holes in round stock can be accurately located for drilling through use of the drill jig illustrated, which was constructed by James Dankelman, a student at the Ralph R. McKee Vocational and Technical High School, New York City. An accurately machined V-block forms the base of the fixture. A bushing carrier slides freely in slots cut into the sides of the V-block and can be locked in place by means of a hand screw on one side of the carrier. Precise positioning of the carrier is accomplished by aligning a center line scribed on the carrier with a scale on the V-block. The workpiece butts against an end stop and is held in place by means of hand screws in the carrier.

Frank Miccio
New York City, N. Y.



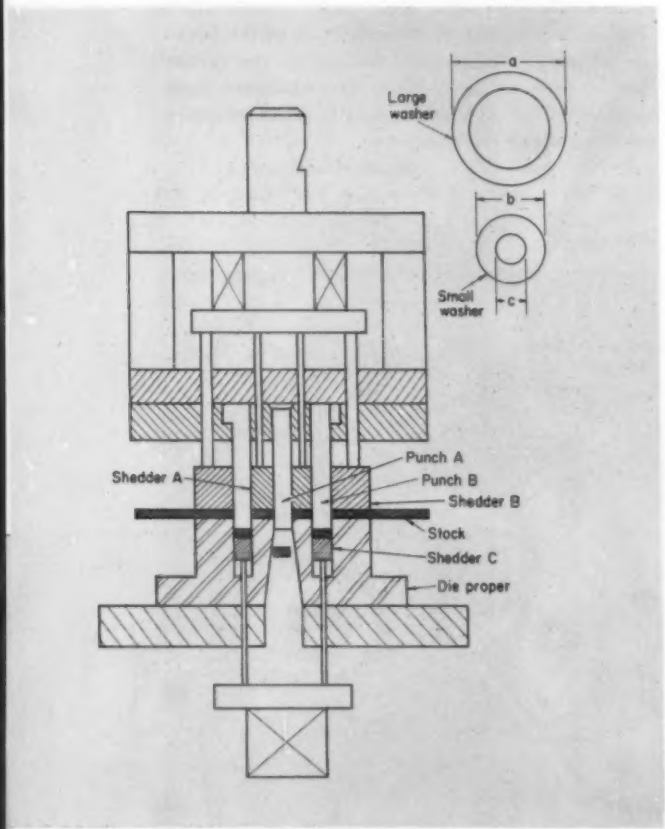


Stripper Bolt Assembly

When conventional stripper bolts are used in a die, it is necessary to add spacers under the heads of the bolts whenever the punch is sharpened to bring the stripper plate flush with the punch. The washers used as spacers must be especially ground to the correct thickness, and making them can consume a considerable amount of toolmaking time.

The stripper bolt assembly illustrated eliminates the need for special washers. The assembly consists of a spacer fastened to the stripper with a standard socket head screw. To bring the stripper plate flush with the punch, the spacer is removed and the required amount of stock is ground off. A number of spacers can be ground in one setting, a time-saving advantage when dies with large numbers of stripper bolts are being worked on.

Cliff Bossmann
Dayton Chapter



Double Compound Die

Recently, production requirements of two washer-shaped workpieces called for the design of blanking-piercing dies. To take advantage of the fact that the ID of the larger washer was equal to the OD of the smaller, a double compound die was designed which produces the smaller washer from the inner scrap of the larger. Thus a set of washers is produced simultaneously with each press stroke, effecting economies of equipment, tooling, material and labor. The tool, shown in closed position, operates like any compound blanking and piercing die, with some differences in design and action.

In the movable part of the tool, a round punch *A* in combination with a hole of standard design in the die proper, pierces the scrap disk, diameter *c*. Around the punch are the following concentric, telescoping members: shedder *A* for returning the smaller washer in the strip; punch *B*, which is a hollow tube and serves as a punch for the larger washer and as a die for the outer contour of the smaller washer; shedder *B*, which holds down the strip during the cutting action.

In the stationary part of the tool there is a sturdy die base carrying the die proper. This, in combination with the corresponding movable members, serves for the following functions: the central hole

is the die opening for punching the scrap; the second circle is the punch for blanking diameter *b*, OD for the smaller washer and ID for the larger washer; the third circle is the die opening for blanking the OD of the larger workpiece. In the circular channel of the die, shedder *C* is located. Two holes are provided for push rods to operate the shedder. This shedder is needed for ejecting the larger washer.

The three shedders are actuated by compression-spring cushions. Other details, such as a disappearing type stop, strip guides and die set are omitted from the drawing for greater clarity.

Federico Strasser
Santiago de Chile

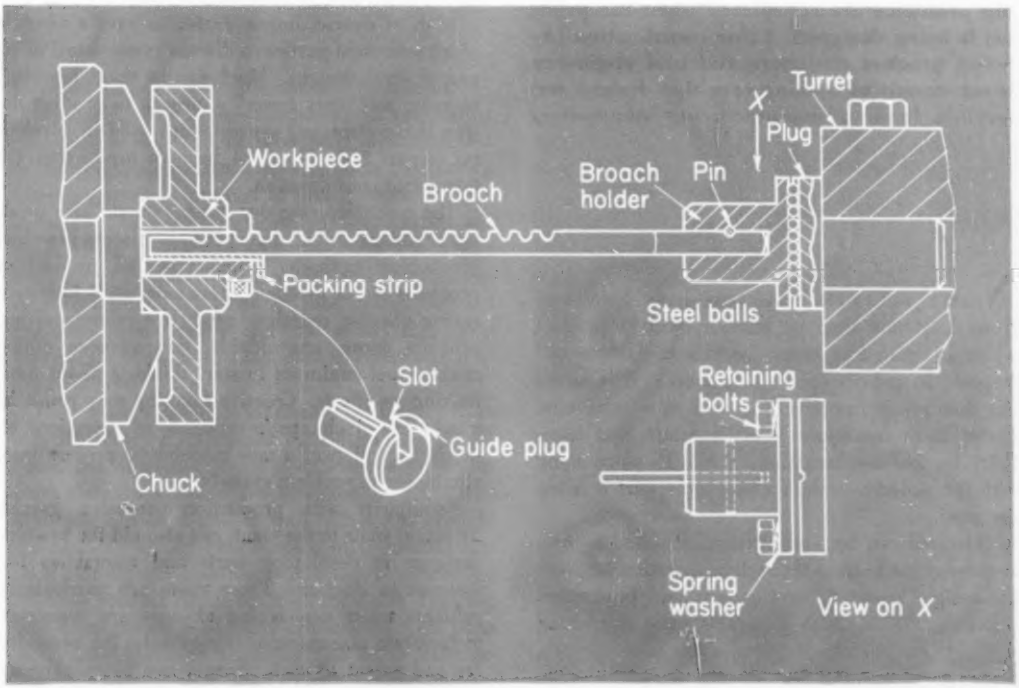
Broaching on a Turret Lathe

When parts are machined on a turret lathe it is possible to eliminate the need for a separate keyway cutting operation on another machine by broaching the keyway while the part is mounted on the lathe. The manual lever which operates the turret slide delivers a powerful thrust which enables the broaching operation to be done in two passes.

The component illustrated is a gear blank held in the chuck so that it can be machined on the outside diameter and in the bore at one setting in order to insure concentricity. The broach holder is attached to the turret by a flanged plug in one of the turret holes. A groove in the face of the plug forms a track for a series of steel balls, running vertically. A similar track is machined in the broach holder so that the broach is free to float in a vertical direction. Broach holder and the plug on the turret are held together by a pair of bolts. A pin holds the broach in the broach holder.

The broaches employed are standard types which are available in sets for use with a mandrel or arbor press. The broach set contains a guide plug which is slip fitted in the bore of the work in which the keyway is to be cut. A slot cut in the plug guides the broach. One pass of the broach is usually sufficient to cut the keyway to half the desired depth. A packing strip is placed under the broach for the second pass.

C. T. Bower
London, England



design and production teamwork reduces costs

By Leon N. De Vos
Product Design Engineer
Engineering Staff
Ford Motor Co.

Tool engineers must translate blueprints into pieces per hour. This task can be made easier and production costs reduced if manufacturing problems are considered when the product is being designed. Close coordination between product designers and tool engineers is one means of making sure that designs are feasible from a manufacturing standpoint.

NEARLY ALL TOOL ENGINEERS have been confronted, at one time or another, with a product which is difficult or expensive to manufacture and inspect. In today's competitive market it is essential that production costs be held to a minimum. Under these conditions it is important that feasibility for low-cost manufacture take its place along with functional considerations when a part is being designed.

This goal can be, and often is, achieved in progressive organizations through cooperation of product design, research, development and production activities, *Fig.* 1. Such factors as basic machining practice, proper dimensioning and available standards, should be given careful review and consideration with respect to production, assembly and inspection problems before designs are released. Teamwork during the planning phase pays off in lower production costs. An added benefit is the elimination of expensive last-minute tooling changes which may be necessary if products are not designed with low-cost manufacture in mind.

It is, of course, impracticable to have a meeting of all interested parties to discuss every detail of all new product designs. Much can be done, however, to avoid an "ivory tower" approach to product design if the steps and processes involved in developing a part from blueprint form to production are taken into consideration.

The manufacturing department should give product engineers ample opportunity to discuss practical production methods. Often potential production problems can be avoided before a design is finalized, saving possible redesign costs. If a manufacturing problem seems unavoidable, this advance notice enables tool engineers to start thinking about minimizing its effects. Creative thinking may result in a solution. A change in sequence of operations or the introduction of a new machine or process may eliminate the problem entirely.

Familiarity with production processes, gained by actual visits to the plant, can also aid the product designer in developing parts and assemblies for low-cost production. These visits are particularly valuable when engineering changes are requested to facilitate manufacture. Frequently, the necessity for and extent of such changes can be quickly re-

Senior member ASTE Detroit chapter

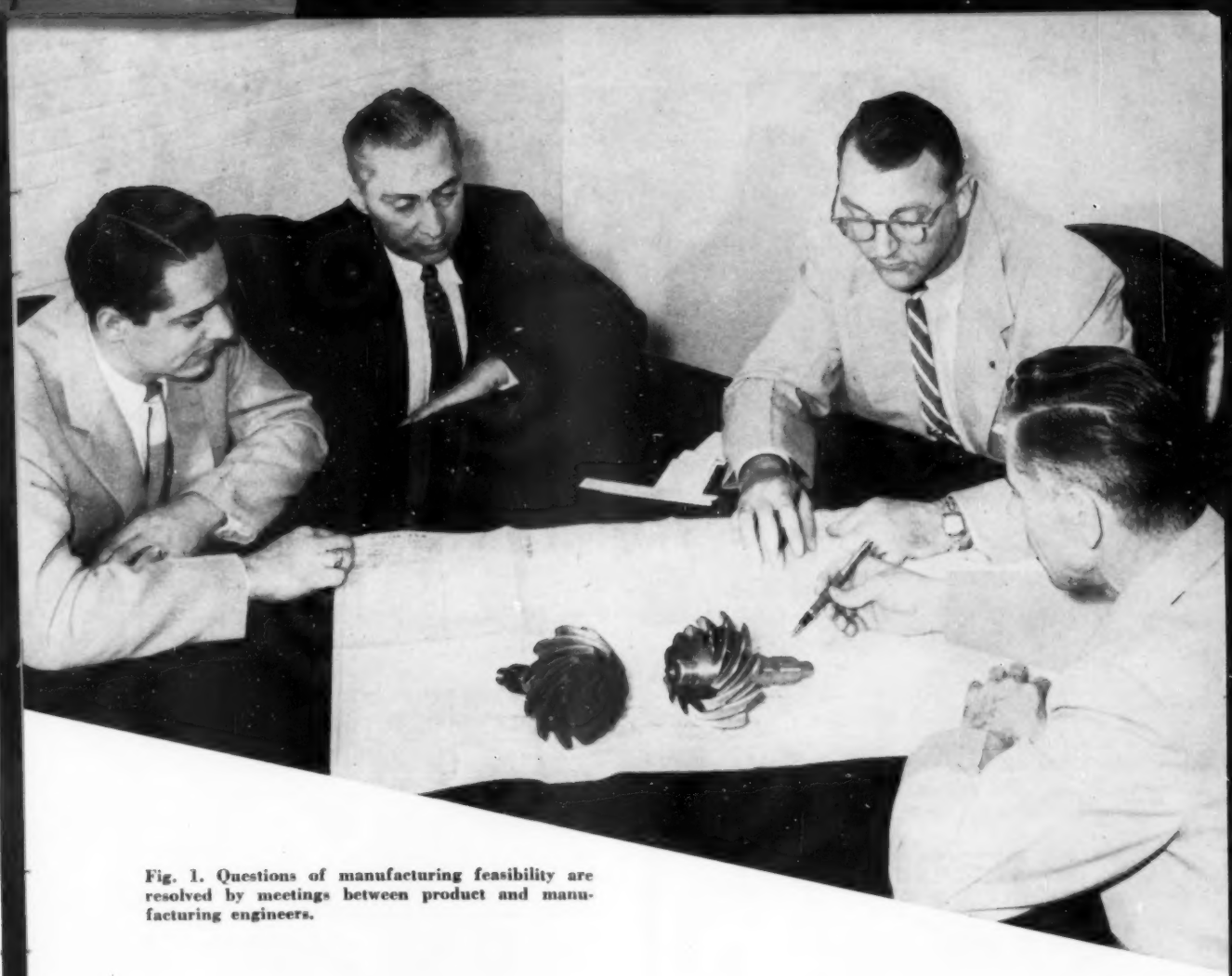


Fig. 1. Questions of manufacturing feasibility are resolved by meetings between product and manufacturing engineers.

solved at the point of production and inspection.

Similarly, difficulties experienced in fabricating prototype models should be quickly communicated to the product engineer. This is an important but often-neglected by-product of prototype model construction. In some organizations, prototypes are made by the production department; in others they are built in the shops of the design and development engineering facility. In either case, design and tool engineers should review and analyze any significant fabrication problems encountered in construction of the prototype.

Even when a design is inherently satisfacory from a manufacturing standpoint difficulties may be encountered in production if specifications on a part print are incomplete or are indicated in such a way that they can be misinterpreted. This was brought out forcibly in one case when control mechanisms on a unit did not function satisfactorily. A meeting between product designers, tool engineers disclosed that detail drawings of many of the component parts were dimensioned in a manner that led to misinterpretation. It was also found that the tolerances were

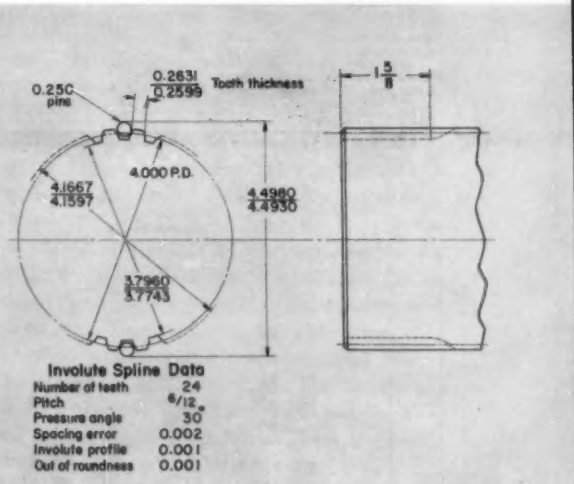


Fig. 2. Original specification for an involute spline can be misinterpreted.

unrealistic in many cases. Based on these findings, the specifications were changed to eliminate the misunderstanding. Also, more satisfactory tolerances were established. Although no basic change in product design was made, units produced subsequently performed as required. While this case is extreme, it nevertheless illustrates the importance of clear and unambiguous specifications on a blueprint.

Sound dimensioning practices are of particular importance. It should not be necessary for the tool engineer to refigure the dimensions from a new baseline in order to locate the part on the proper critical surface from the standpoint of machining or inspection. Specifications must be such that there can be no doubt as to what must be inspected. "Double dimensioning" should be avoided, since it can lead to confusion and can possibly lead to two inspection operations on the same dimensions. An example of such a condition is the specification of both tooth thickness and an over-wire dimension on a gear drawing.

Many drawings and specifications that appear to be adequate and complete actually lack information required to tool the part. This is true of the specification for the involute spline shown as *Fig.* 2. The tooth thickness and over-pin dimensions are given but the specification does not indicate how this part fits into the mating part. Limits for spacing, form and eccentricity are shown. There is no indication, however, whether or not these are allowed in addition to the tooth thickness tolerance. Major and minor diameters are shown but they are not clearly indicated. The spline length dimension is open to question.

These deficiencies are avoided in a second drawing of the same part, *Fig.* 3, where specifications have been established with production in mind. Tooth thickness is indicated so that there can be no question of what it is. Minor and major diameters, as well as pitch diameter and maximum form diameter, are definitely established. Active spline length is specified.

Comparison between *Figs.* 4 and 5 reveals a similar improvement. Specifications in the latter drawing are readily understandable and cannot be misinterpreted.

In the final analysis tool engineers and product designers have a common objective: the production of high-quality parts and assemblies at the lowest possible cost. Teamwork and the cooperative solution of mutual problems will assure that this objective is met.

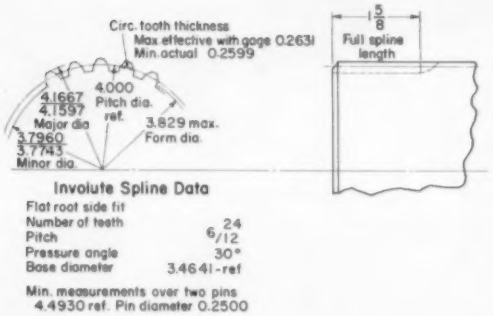
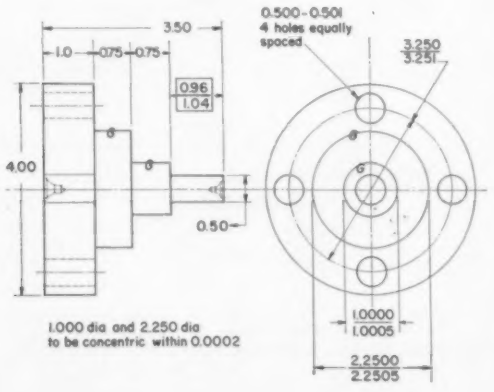


Fig. 3. (left) Specification for involute spline revised to eliminate possible erroneous interpretations.

Fig. 4. (lower left) Drawing of small machined part. Full information required for production is not given and pertinent dimensions are not conveniently located. The dimension shown in the box is unreasonable because of the possible tolerance build-up caused by improper specification.

Fig. 5. (below) Improved drawing of small machined part is easy to read and cannot be misinterpreted. The dimension shown in the box is controlled.



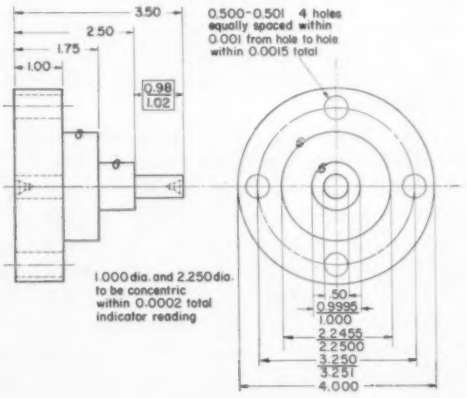


Fig. 1. Work area of a tape-controlled cam-milling machine. The ball-end milling cutter is rotated by a separate motor.

CAMS WITHOUT MASTERS

By Robert C. Sims
Senior Engineer
Research Laboratories Div.
Bendix Aviation Corp.
Detroit, Mich.

IN COMPLEX cam control systems, the production of master cam models can be a major bottleneck. Master and cam production problems are magnified if the control system is for use in an airplane, where weight and size are important limitations. A tape-controlled cam-milling machine, *Fig.* 1, can do much to minimize these problems and limitations.

In a modern jet engine, a rather elaborate fuel control system is required in order to keep the engine generating a specified amount of thrust under varying operating conditions. Fuel requirements vary considerably with changes in a number of quantities. Even if a human operator could manually control fuel flow to compensate for the changing conditions, the modern pilot is too busy doing other essential tasks. Fuel flow control must be automatic.

One approach to the control problem has been to detect the variables of interest, convert them into proportional mechanical motions by means of transducers and use these motions in a mechanical linkage system whose output controls a fuel flow valve. Relationships between the fuel flow requirements and the various variables cannot usually be expressed as mathematical functions. They have to be determined experimentally from engine tests.

In the linkage system, three-dimensional cams, *Fig.* 2, can be used to relate the motions in the proper manner. Because these cams must be as small as possible, production tolerances must be close so functional accuracy can be achieved.

From information presented at the First Annual Detroit Conference on Tooling and Materials.

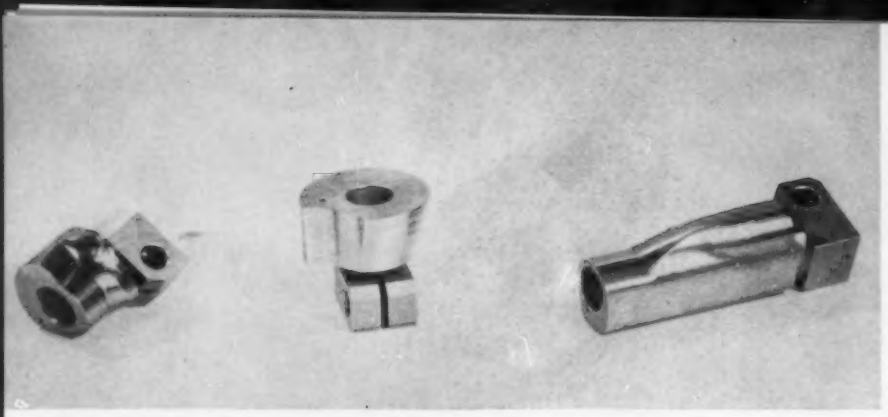


Fig. 2. Typical three-dimensional cams used to weight effects of a number of variables and relate them to another function.

Conventional Methods

Before a tape-controlled cam-milling machine was developed, cams were produced as shown in *Fig.* 3. The curves represent experimentally determined relationships between fuel flow and engine speed at various levels of ambient temperature for a single value of thrust. If these were the only variables involved (and usually they are not), a cam could be designed to relate them. If the angular position of the cam could be determined by engine speed and position of the follower along the axis could be determined by ambient temperature, then the distance of the follower from the axis of rotation of the cam could be proportional to the desired fuel flow. This is precisely what is done. Effects of other variables are taken care of by other parts of the linkage.

The three-dimensional cam is designed as specified radii at specified angles of rotation at specified positions along the axis. These specifications are met in production by preparing templates corre-

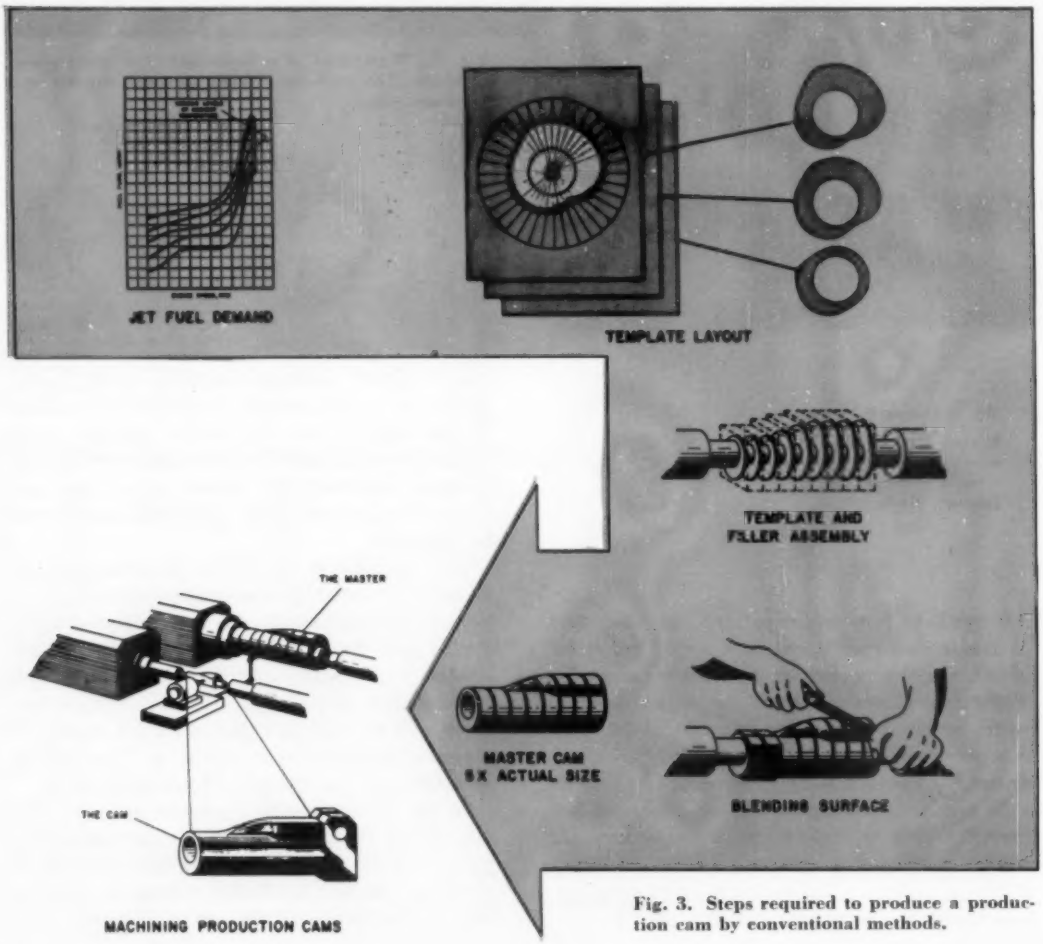


Fig. 3. Steps required to produce a production cam by conventional methods.

sponding to the cross sections of the cam. The thin templates are then accurately spaced and mounted on a mandrel. Lead, or some other readily workable but reasonably hard material, is used as a filler between the templates. This filler is worked with hand tools by skilled craftsmen until a smooth surface is achieved through all the template contours. This master cam is generally made five times the desired cam size in order to reduce possible errors. The master is then used in a duplicating machine to produce cams of the desired size in the required number.

Production with Tape Control

Cams are designed in the same way when they are to be produced on a tape-controlled cam-milling machine. The design data is punched on cards for use in standard punched-card accounting machines. This equipment performs necessary computations and then punches a second set of cards. These, in turn, are used to automatically punch a tape that can be used to control the machine, *Fig.* 4. The machine automatically cuts the cam contour to the required size out of a hardened steel blank.

Times involved in the two methods are compared in the accompanying table. The major advantages of tape-controlled cam milling lie in the reduction of tooling preparation and lead times. Since it is frequently necessary to produce and test several cams before production runs can be started, reduction of lead time from several months to less than one week is important.

Machine Characteristics

In the configuration of the machine elements and in the manner of handling the workpiece, the tape-controlled cam-milling machine, *Fig.* 5, resembles a lathe. The cutting tool, *Fig.* 1, is a ball-end milling cutter that is rotated at high speed by an auxiliary motor. With this design, noncircular cross sections can be cut easily. A control unit, Fig. 6, is associated with the cutting machine. The main portion of the electronic control circuitry is made up of plug-in units of digital computer type circuitry.

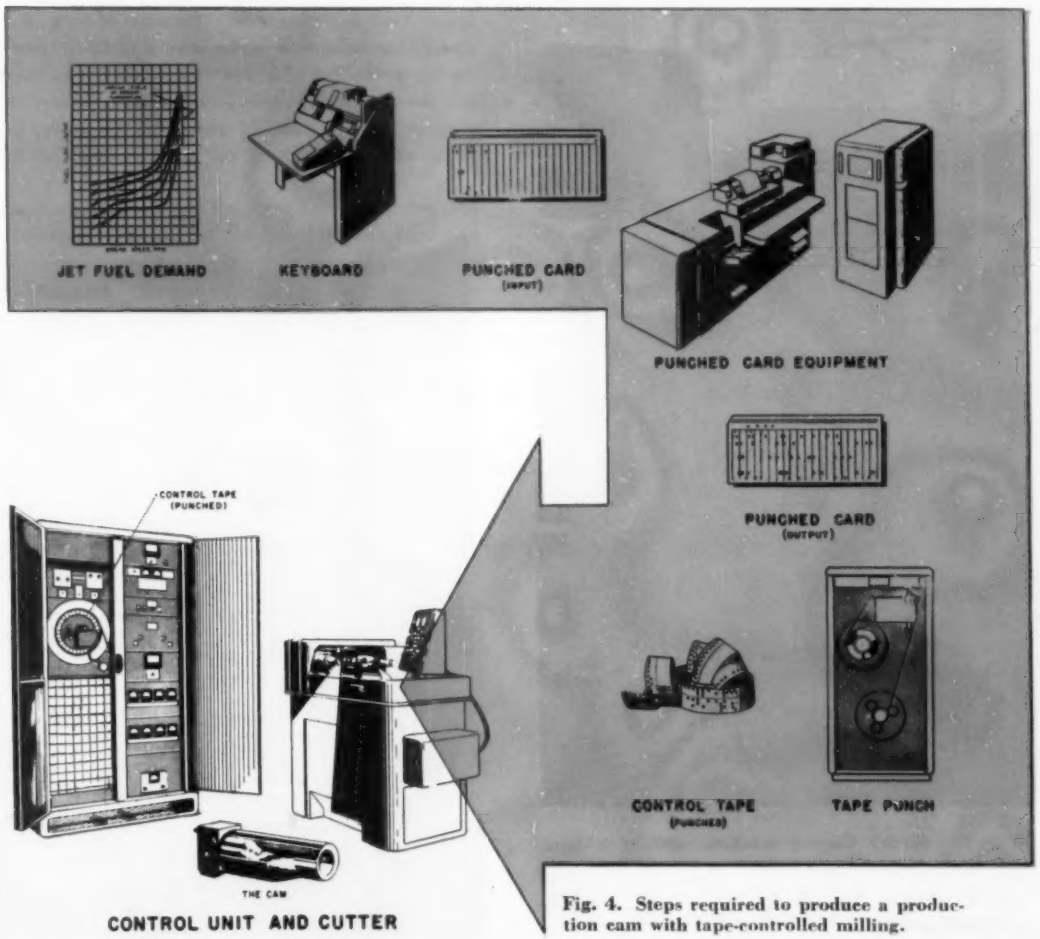


Fig. 4. Steps required to produce a production cam with tape-controlled milling.

Tooling and Production Times for Cams

Factor	Specially-Tooled* Lathe	Tape-Controlled Machine
Type of Tooling	Master cam	Punched tape
Tooling Preparation (hours)	200 to 400	20 to 30
Tooling Lead Time (weeks)	9 to 18	<1
Machine Setup (hours)	16 to 24	4 to 5
Cutting Time (hours)	3 to 8	4 to 12

*Lathe equipped with milling cutter and duplicator attachment.

This portion of the equipment is actually a special-purpose digital computer that receives information from the tape and provides signals to control the cutting machine.

The manner in which the work is handled is shown in the schematic diagram of *Fig. 7*. The workpiece is mounted on a spindle that is geared to the same shaft that drives the longitudinal carriage lead screw. The carriage, which moves parallel to the axis of the workpiece spindle, carries a cross slide on which the cutting tool is mounted. The cross slide is driven perpendicular to the axis of the workpiece spindle by a lead screw powered by a hydraulic motor.

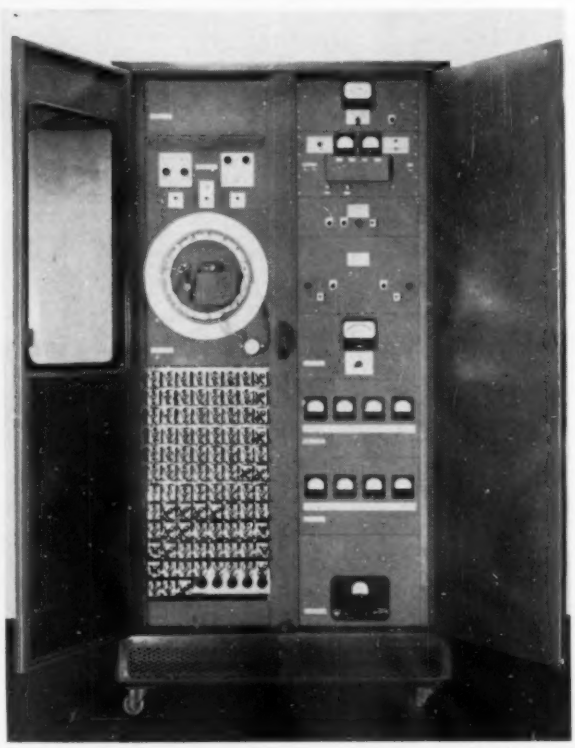
Fig. 5. (above) Cutting machine unit of a tape-controlled cam-milling system.

Fig. 6. (right) Control unit for a tape-controlled cam-milling system.

The spindle drive motor is run at a constant speed, determined by information on the tape. As the motor rotates, the workpiece rotates, the carriage is driven longitudinally and spindle pulses are generated at a fixed rate (512 pulses for each 10 deg of spindle rotation). These pulses are fed into the interpolator, as is cross slide control information from the tape. The interpolator coordinates the two sets of data and puts out command pulses to control the position of the cross slide. The command pulse path is through the error register, the cross feed servo amplifier and the cross feed drive motor.

As the cross feed drive motor rotates, feedback pulses are generated and fed into the error register. There, the number of command pulses that have been generated is compared with the number of feedback pulses. If these two values are different, a position error voltage is generated. This voltage causes the drive motor to turn in such a direction as to generate feedback pulses that will reduce the error toward zero.

Since a cam blank is usually a cylinder with a radius slightly larger than the maximum cam radius, considerable metal must be removed from the minimum cam radius section. Because of this, it is usually necessary to make several cutting passes during production of a cam. Simple control switches are provided in the control unit so the operator can program the number of passes to be made, the depth of each roughing cut and the depth of the



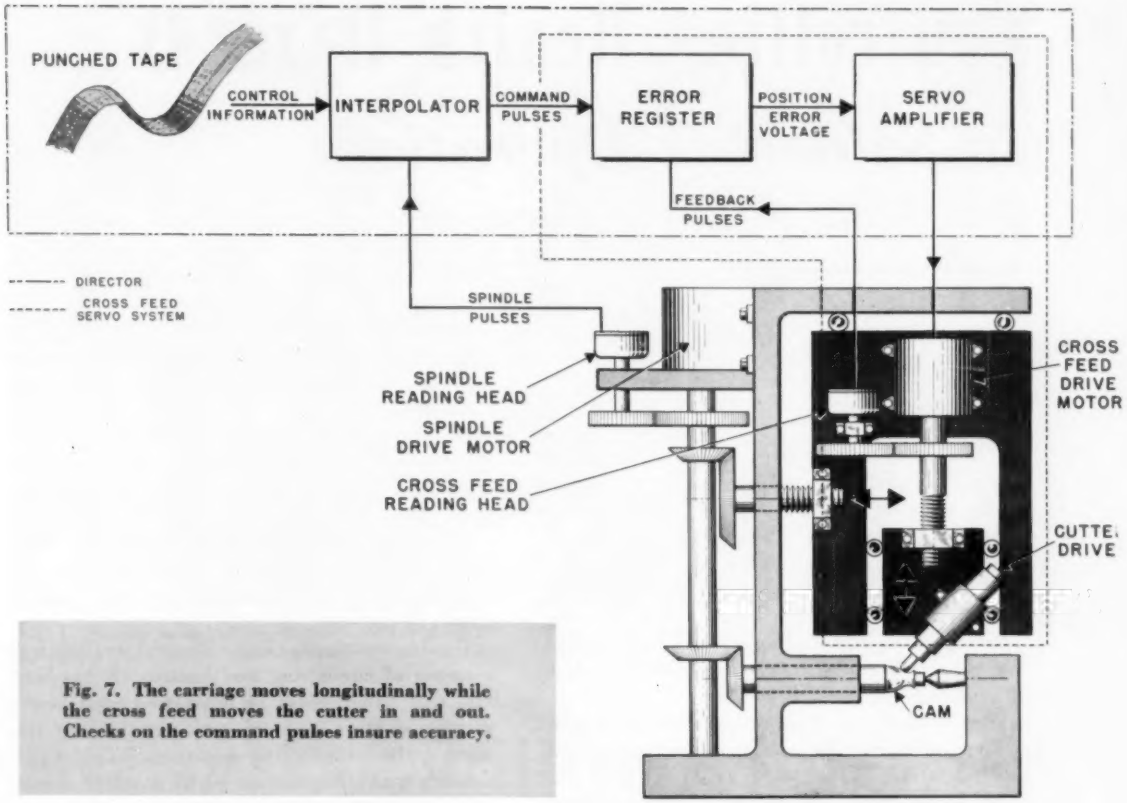


Fig. 7. The carriage moves longitudinally while the cross feed moves the cutter in and out. Checks on the command pulses insure accuracy.

finishing cut. After the operator programs the passes and sets up the machine, the machine will completely cut the cam specified by the tape and return to its initial position. If another cam of the same type is to be cut, it is only necessary to mount a new blank and push a button.

A tape-controlled cam-milling machine can be operated by regular machine shop personnel for sustained periods. Preventive maintenance routines can reduce unscheduled maintenance, both mechanical and electronic, to a negligible value. Cams can be made accurately within ± 0.001 inch under worst conditions at specified points. Between specified points, accuracy varies depending on the contour of the cam and the point spacing. Points can be specified as close together as desired but cutting speed may be reduced when points are close.

'Stationary' Conveyor Line for Radioactive Materials

In the chemistry and metallurgy research division at Los Alamos Scientific Laboratory, radioactive materials are moved into and out of contaminated areas with complete safety to workers. Transportation is by means of "dry boxes" carried on a Monoflo conveyor. The boxes act as shielded chambers safely enclosing radioactive material as it is transported through work areas.

Useful feature of the system is that although the item to be conveyed moves through an area smoothly at a controlled speed, and can be stopped at any point in its travel, the conveyor itself does not move out of the area. It consists of a flexible steel cable with a spiral outer surface retained in a metal casing or rail with an open top large enough to expose only the spiral. The cable is rotated by a motor drive coupled to one end, and the rotation causes any load hooked over the cable to be propelled forward by the spiral. Differing from conventional chain or belt conveyor which moves with the load, this system with its supporting rail remain in place while the load moves ahead.

As a consequence, material that is to be moved into and out of a contaminated area is loaded at a portion of the conveyor which is always safe since it remains in a nonradioactive zone.

Controlling Health Hazards
in Soldering Operations

By W. Schweisheimer, M.D.
Rye, New York

FUMES AND DUST from soldering operations can be extremely injurious to worker health. Numerous studies of soldering hazards have been made by government and industry groups and it is generally agreed that the best protections for workers are adequate ventilation and good housekeeping practices. While this recommendation is not new, the increased use of high-lead solders as a tin conservation measure has substantially increased the danger of poisoning.

When soldering is done on a continuous or production basis, good general ventilation plus local mechanical exhaust ventilation is a necessity. Exhaust hoods should be provided over soldering benches and the rate at which air is exhausted should be at least 100 cubic feet per minute per square foot of grille area. Stoves or heaters for soldering irons should be enclosed on three sides, with mechanical exhaust at the same rate. The exhausted air should be discharged to the outside atmosphere in such a way that it cannot re-enter the building.

Industrial hygienist using an electrostatic sampler to check concentration of dust in an automotive body soldering area at the Dearborn Assembly Plant, Ford Motor Company.

Soldering enclosures should be designed so that the air is drawn over the source of the polluting material and away from the machine operator. The better the enclosure, the smaller is the amount of exhausted air required to be effective as protection. If it is necessary to remove part of an enclosure for servicing a soldering machine, a stronger exhaust should be provided.

Good housekeeping ranks with good ventilation as a means of minimizing lead hazards. It has been said that "what would be considered good housekeeping at other kinds of work may be only fair when applied to soldering operations." This is particularly true for operations where powdery drosses are formed. These drosses trend to accumulate on gas muffles, surfaces and edges of solder pots and tanks, gas torches and surfaces of soldering irons. This material must be handled carefully so that there is as little spillage and dispersal of dust into the air as possible.

An additional hazard involved in soldering operations is that irritant gases may be generated from the flux. Gases from acid fluxes give rise to irritating vapors and may cause inflammation of the skin. Rosin fluxes are also irritating. Even the workpiece itself may give off harmful vapors when heated, as in the case of parts which have been treated with chlorinated vapors.

Where dangerous concentrations of lead dust or fumes exist, and, because of the nature of the operation, cannot be fully controlled through ventilation, workers should be protected by wearing respiratory protective devices. If an acid-free flux is used, a mechanical-filter respirator of the type approved by the United States Bureau of Mines will suffice. Otherwise, an approved supplied-air respirator will be required.

Silver soldering hazards are similar to those associated with lead soldering, and the same protective measures should be utilized. With good housekeeping, adequate ventilation and the use of respiratory protective devices, soldering hazards can be controlled and worker health protected.

Fig. 1. Simple work-holding device used for multiple operations in a single hole location. By eliminating the need for work movement, production of the part shown was doubled and rejects cut by 85 percent.

Medium-Run Drilling and Tapping

.....turret machines provide the best answer

By Arnold Charlat
Chief Engineer
Howe & Fant, Inc.
East Norwalk, Conn.

In recent years, much attention has been given to high-production drilling and tapping operations while relatively little attention has been given to the problems presented by short and intermediate runs. This is surprising since the bulk of drilling and tapping falls into the latter category. In the majority of cases, these short and intermediate runs are still handled by expensive, makeshift methods.

However, machines and tooling are now available that are relatively low in cost and that permit short and intermediate-run drilling and tapping jobs to be handled efficiently and without loss of job flexibility. The modern turret drilling and tapping machine provides a multiplicity of spindles which operate under a common axis, thereby minimizing the need for work movement. An infinite variety of speeds is available to provide optimum cutting conditions for each operation. All spindles can perform either drilling or tapping as needed and can be preset to very accurate depths independently. Machine adjustments are positioned to facilitate setup and operating controls are placed in a conventional location and provide the sensitive feel essential for high quality work.

Obtaining the machine, however, is not enough. It is of extreme importance that the fundamentals of the machine be known and that it is tooled properly. If it isn't, many of the savings which it makes possible may not be realized.

Methods of holding the work play an important part for optimum performance. Where it was necessary to move the work from one spindle to another, it was commonly accepted procedure to use box jigs. Such jigs have certain basic shortcomings. They are costly to build, cumbersome to handle,

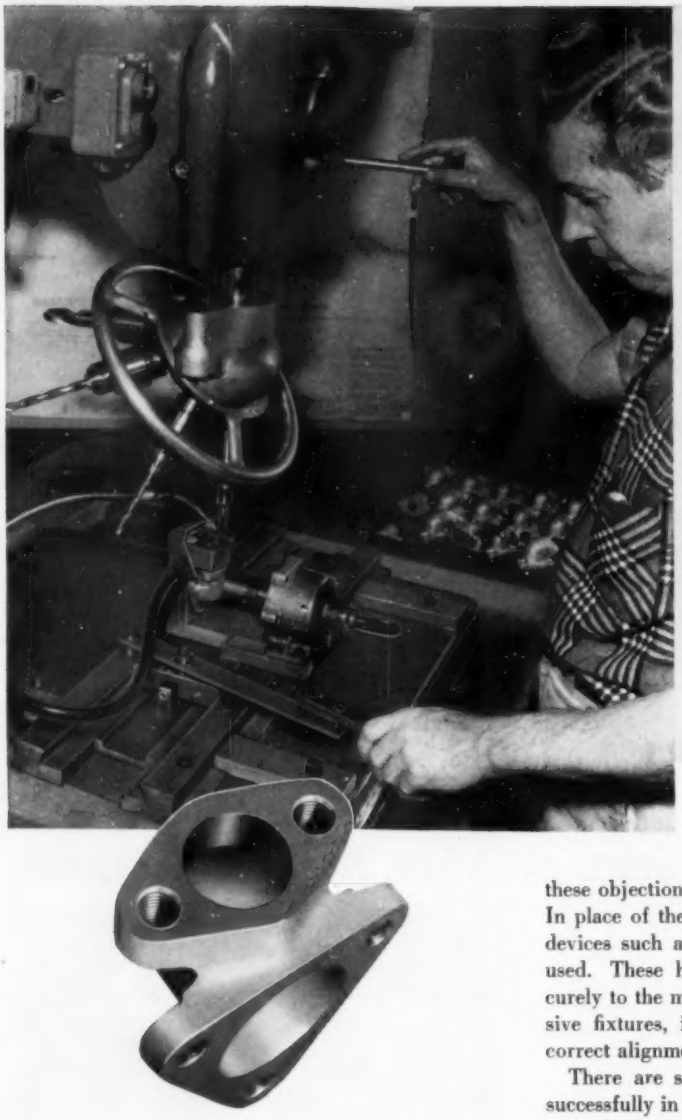


Fig. 2. An air clamp, mounted on a simple 3-position slide type fixture, used for multiple operations in a straight line pattern. This setup increased production of the elbow illustrated by 53 percent and virtually eliminated rejects.

slow to load and unload, difficult to keep clean and subject to error because of being constantly knocked about.

Another defect in normal drilling and tapping operations is the manner of aligning the drill bushing with the cutting tool. Since it is generally difficult to provide accurate means of alignment at different spindle locations, the tool itself is used to pull the work holder into position before actual cutting is started. Extensive down time, a high percentage of rejects plus costly maintenance and replacement of perishable tools is the inevitable result, particularly where tools of multiple diameters such as combination counterbores are used.

With the use of a turret type drilling machine, these objectionable factors can easily be minimized. In place of the box jig, simple but rugged holding devices such as air clamps and pump jigs can be used. These holding devices can be fastened securely to the machine table or mounted on inexpensive fixtures, insuring rapid work movement and correct alignment.

There are several approaches that can be used successfully in intermediate-run drilling and tapping operations. An understanding of the basic factors can provide the necessary stimuli for forward productive planning. These factors fall into four categories for multiple operations.

Multiple operations in a single hole represents one of the simplest and most efficient applications for turret drilling machines. The work-holding device is fastened securely to the worktable in accurate alignment with the machine spindle line of action. No work movement is required between operations, *Fig.* 1.

A regular straight-line pattern is easily accomlished by mounting a simple holding device on a slide mechanism with preset stops. Tooling is relatively inexpensive, and assures minimum transfer time and correct location of the part under the cutting tool. Box jigs, heretofore used for work of this

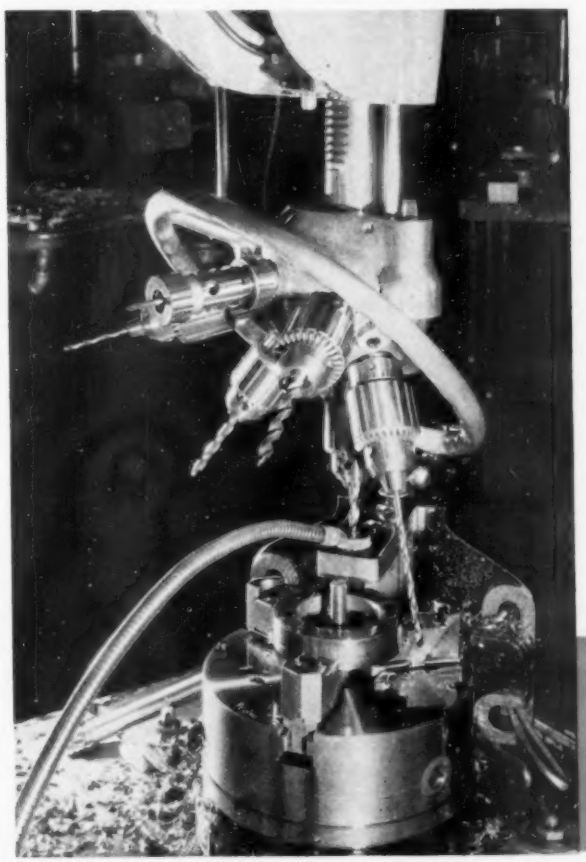
nature, are unnecessary, *Fig.* 2.

Regular circular patterns can be accomplished with a turret drilling machine using a simple index fixture with a single handling of the work. Concentric bolt circles may be produced by combining an index fixture with a slide mechanism and preset stops. This combination is a general-purpose type of tooling that can be used for a variety of jobs, *Fig.* 3.

For irregular patterns, positioning tables, *Fig.* 4, have recently been developed that reproduce any hole pattern within their capacity and which are simple in design, low in cost, fast acting, consistently acurate within 0.001 inch and easily changed from job to job.

The fixed base of the positioning table is bolted to the machine. A hole location plate for the particular job to be run is inserted in the moveable portion of the table, much as a record is placed in a phonograph. A work holding device, which may or may not include guide bushings, is then mounted on the table. To move from one location to another, the operator simply depresses a lever and slides the movable portion, which rides on ball bearings, to the approximate hole center for the next operation. At this point a locking mechanism automatically pulls the table into correct alignment with the machine spindle. Production increases to be gained from tooling of this type are extremely high, in some instances more than 300 percent.

Intermediate-run drilling and tapping jobs can usually be economically done through use of one of the foregoing basic turret tooling approaches. There are, of course, many variations of these basic approaches but careful analysis will usually show that any drilling and tapping job can be accomplished with one, or a combination of several, of the methods outlined. Properly applied, turret type machines provide the answer to medium or short-run drilling and tapping.



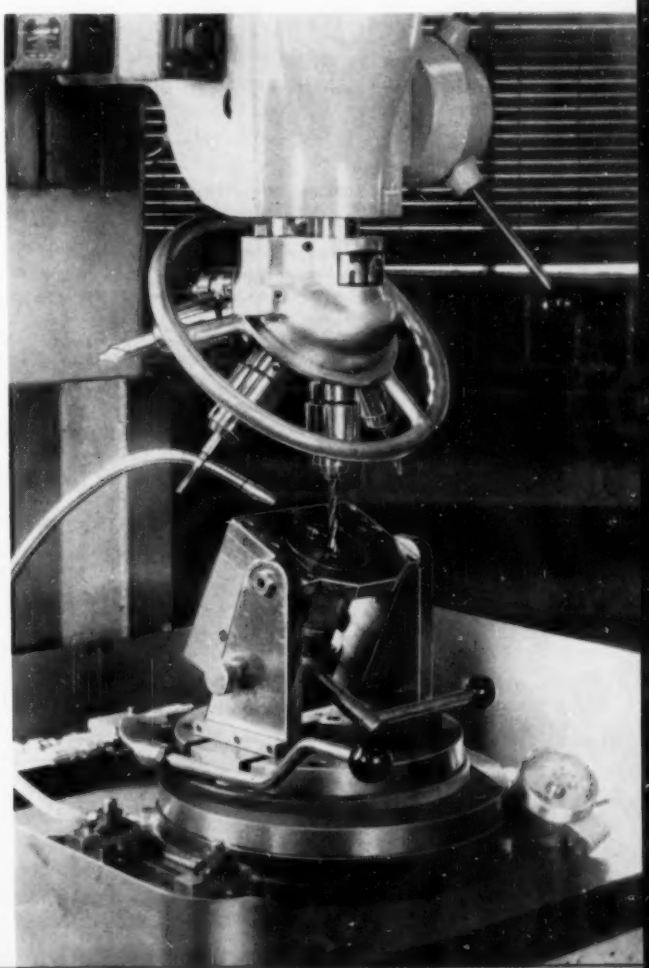


Fig. 3. (right) A universal indexing fixture being used for multiple operations in a bolt circle pattern.

Fig. 4. (above) A trunnion type work-holding device, mounted on a universal positioning table, used for multiple operations in an irregular pattern and at different angles. This tooling substantially increased production of the part shown.

HOW tool engineers can

By Stuart P. Hall*
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Detroit, Mich.

Few subjects are of more intimate concern to ambitious engineers than that of this article. The author writes from experience—he has been through the mill himself. A mechanical engineering graduate, he entered GM via the management training route. He held design and production engineering positions at Buick Motor Div. until he entered the technical publication field, eventually becoming chief editor of *Design News*. He now heads his own industrial consulting firm.

PROBABLY AT NO TIME in American history have executives with manufacturing know-how been more badly needed by industry than at present. More and more tool engineers are being advanced to executive positions. They are doing excellent jobs. The reason that many tool engineers fail to advance into management probably lies within themselves.

In the days before World War II, the tool engineer admittedly lacked prestige; his profession was underrated and most tool engineering was done in conjunction with and under the direct supervision of busy shop managements. Today, thanks in part to the efforts of ASTE, tool engineering is a recognized profession.

Thus, the profession of tool engineering itself is no longer suffering from a lack of public relations activity. The rest of the solution to the problem of how more tool engineers can advance into executive positions is squarely up to each man himself.

Why do managements pick certain individuals to be executives? What does a person have that makes him a candidate for an executive position? First, of course, he must have technical knowledge. Knowledge of tool engineering can be acquired either through shop and tool engineering experience or by combination of a college education and a considerable amount of tool engineering experience. The lack of a college education does not bar a tool engineer from becoming an executive. Admittedly, however, the man with a college education may become an executive at an earlier age due to the head start that a college education can give him.

Nevertheless, a wealth of knowledge is simply one, and not the only, qualification for selecting a man for an executive position. The other important points in executive selection depend on the man's personality characteristics. Is he well-liked? Does he have the respect of his bosses and his coworkers? Can he get other people to cooperate with him and do things for him? Can he keep his temper when the going gets rough?

If there is a single thing that has retarded the development of tool engineers into executives, it is the mistaken notion that technical knowledge, and that alone, is the key to an executive selection. Too many tool engineers are more concerned with whether a good idea was theirs than with how much it cut costs. The man who fails to realize that no idea—no matter how good—can be brought to fruition without the help and support of others, will never be

A good executive gets things done through others.

*Senior member ASTE Detroit chapter

become executives

considered for an executive position.

What, then, are the basic traits that a tool engineer should have or develop that will assure his advancement to an executive position? First, he should be intelligent. He need not necessarily be brilliant although, contrary to many current opinions, brilliance is certainly no retarding factor in becoming an executive. Secondly, he should do what he is told—pleasantly and without much discussion. If he has a good reason for disagreeing with the order, he would point it out to his superior; not selling his idea, he would then promptly go about doing it the way he was told. If it later proves that his idea about doing the job was better than the method he was told to follow, he would not bring this point to the emphatic attention of his superior. Supervisors find their mistakes quickly enough and are only too glad to do it the right way the next time. Further, they never forget who originally suggested that the method was wrong. A person gets credit without taking credit if he behaves like a gentleman.

Thirdly, this embryo executive would be a creative thinker—a self-starter as these types of people are often termed. They don't wait for someone to tell them to make improvements; they see the need, suggest the change and go through the proper channels to get the improvement accomplished.

Being a good creative thinker and doer implies an aggressive personality and a will to work. These are, of course, qualities that every executive must have. He should never be aggressive, however, to the point that he steps on toes and hurts many people's feelings.

The fourth quality of a good executive candidate is an inherent ability to get things done, to follow them through, to check on results and to make adequate reports on progress and accomplishments. A good tool engineer executive doesn't issue an order and then wait patiently for things to happen. He follows it up and asks for reports, and he is always in a position to make up-to-the-minute reports to his superiors when they request them.

One typical problem that every tool engineer has is to get tools designed and built on the job in a hurry. It means a lot of cooperation, prodding and follow-up through tool design, tool manufacture and machine repair departments. Success is achieved by keeping promises. If a tool engineer tells a designer he needs a job by a certain date, he should be there that day to pick up the drawings. If the tool manufacturing department is rushing a hot job through for him, he is there the minute they say it will be ready. If the heat suddenly comes off a job, a good tool engineer calls up everybody concerned and informs them of the change in status. If a man gets the reputation of failing to follow through or not keeping his promises, he is much like the shepherd who cried 'wolf'—no one believes him or will cooperate with him.

Self-starters are always in demand. This is an essential quality for an executive to have.

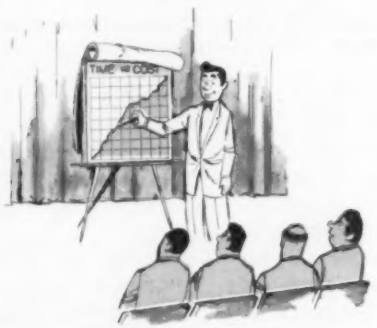
One other important point that will assure the advance of a young tool engineer to executive positions is humility. Too few people realize that what their friends and associates think and say about them does more to promote their cause than shouting

from the housetops. By humility is meant a sincere humility, not something put on. Any successful executive today will honestly admit that his rise up the ladder depended a lot on the help of others—the training the company provided and the brain the Creator gave him. Truly, a man who reaches the top must be a humble person.

Of course every tool engineer cannot be an executive and it should not be inferred that a man is not a successful tool engineer if he has not become an executive. Executives are expected to do many things. Such positions are not all vacation, expense

Executives must be able to delegate authority and trust others to handle details.

account and bonus propositions. An executive is on call 24 hours of the day, seven days a week. He carries responsibilities that he never knew existed until he got the job. He has to carry out a lot of what he probably once thought were unimportant duties, such as raises, promotions, union bargaining arrangements and meetings, meetings, meetings. He quickly finds that he doesn't have too much time to do creative thinking. Being an executive involves a lot of paperwork and possibly moving from town to town at the slightest whim of management, and regardless of what his wife thinks about the change. So if a tool engineer, in the face of these responsibilities, still chooses to be an executive, he should



Ability to handle a meeting is a requirement for executive selection.

examine what he has to do when he gets that first chance at it.

Assuming that a tool engineer executive candidate has exhibited all the favorable traits listed, there is one major stumbling block that he must overcome lest he ultimately be returned to his original position. That is in the delegation of authority. An executive must issue orders, check and follow up but, above all, he must delegate authority. Probably the number one cause for failures, ulcers and coronaries among executives today is this inability to give up the details.

An executive must surround himself with associates he can trust. This is the reason why an executive often has a group of people move with him from company to company, or from position to position within a company. More than one budding young executive has become associated with a so-called "comer" and followed along with him from position to position. This is an excellent training method . . . but slightly precarious should the management of a company suddenly be changed or swept away.

A successful executive must know how to run meetings and how to ask questions that will enable him to make the right decisions quickly. He will never let a meeting start without an agenda nor will he let a meeting get out of hand and end up in a name calling session. He knows how to let a good secretary take care of most of his details for him and he tries to take a little time out for relaxation whenever he can.

Of course a good executive must handle people well. He doesn't reprimand people in front of others and he never blames his subordinates for his own mistakes. If a tool engineer does not exhibit such qualities in his first executive assignment, the best he can expect is to miss out on future promotions.

A good executive treats all around him courteously and never makes the mistake of thinking that a quick decision is the best decision. He is probably a better listener than he is a talker, and he has found from experience that he is more effective when he does not reveal all the thinking processes through which he went to make a decision. It is a fact that top executives learn these points the hard way. If they didn't they probably never would have reached the top.

How can a tool engineer who so desires direct himself into an executive position? He should immediately recognize that if he wants the top executive job, he must have a well-rounded background. A company that offers him a complete training program before they place him in any particular department gives him a better chance to be placed in the right spot initially. He recognizes too that he must start at the bottom and not at the top nor even near the middle, if the company is to transform him,

it's investment, into a sound executive who can later guide the progress of the company.

The young tool engineer wanting to be an executive should always indicate an interest in all phases of operations of the company. If he has a few minutes when he is walking through the shop he should stop and look, ask questions and learn all he can about what the company is doing during the time available. On the other hand he never shirks his job in order to get this sideline education.

If the company has social events or department parties, he usually attends and offers to help with the arrangements. If he has any athletic ability he probably participates in the program. If the company has voluntary foremanship, public speaking or night courses in executive training, he eagerly signs up for them.

If a job has to be done which requires a little work at home on his own time, he undoubtedly does it without any verbal display. On the other hand, he never shows his lack of ability to do his work within the hours provided by taking it home with him every night.

As far as work assignments are concerned, he gladly accepts whatever is handed him. If new opportunities in other departments are offered to him, he gladly accepts these also in the interest of broadening his knowledge.

There are many good positions open to tool engineers in the lower executive levels in the operation of a company. Suppose that a tool engineer finds an area of interest to which he would like to devote his life. It might be gears, for example. He can direct his efforts toward being an expert in the specialized gear field. There are good opportunities to become a department head in a field of this type. On the other hand, it is quite rare that an executive in a specialized field such as gearing would become a top management executive except in a company whose main products are gears or related components.

Public reprimand of employees ruins an organization's morale.

It is well to always remember, however, that money and position alone are insufficient rewards in life, unless a man is working on something he enjoys. The best executive is a happy executive and if being a specialist suits a tool engineer he can still strive for executive or leadership positions within that field.

What should a tool engineer do when he feels he has exhibited all the qualities of an executive and nothing has been done about it? There are several reasons why tool engineers with excellent executive qualities fail to get executive positions in their companies. Some companies hate to advance a man from a spot where he is doing an excellent job, particularly when they have no one to replace him. This statement implies a very important point: avoid taking the attitude of trying to conceal knowledge from coworkers or associates. For some reason the source of information is usually well known. An executive "comer" always gives away information to his associates or those directly under him. Nothing will eliminate the statement, "But there's no one around to replace him," so effectively.

Even an executive can be a square peg in a round hole and sour on the job.

In other companies there may be no present need for more executives. Perhaps the management is a young group that can carry on for years. It is up to tool engineers who want executive positions to analyze their position. If there is no future in it as far as being an executive is concerned, and this may not be the fault of the company at all, there is just one thing to do and that is to move to another company where such talents are needed.

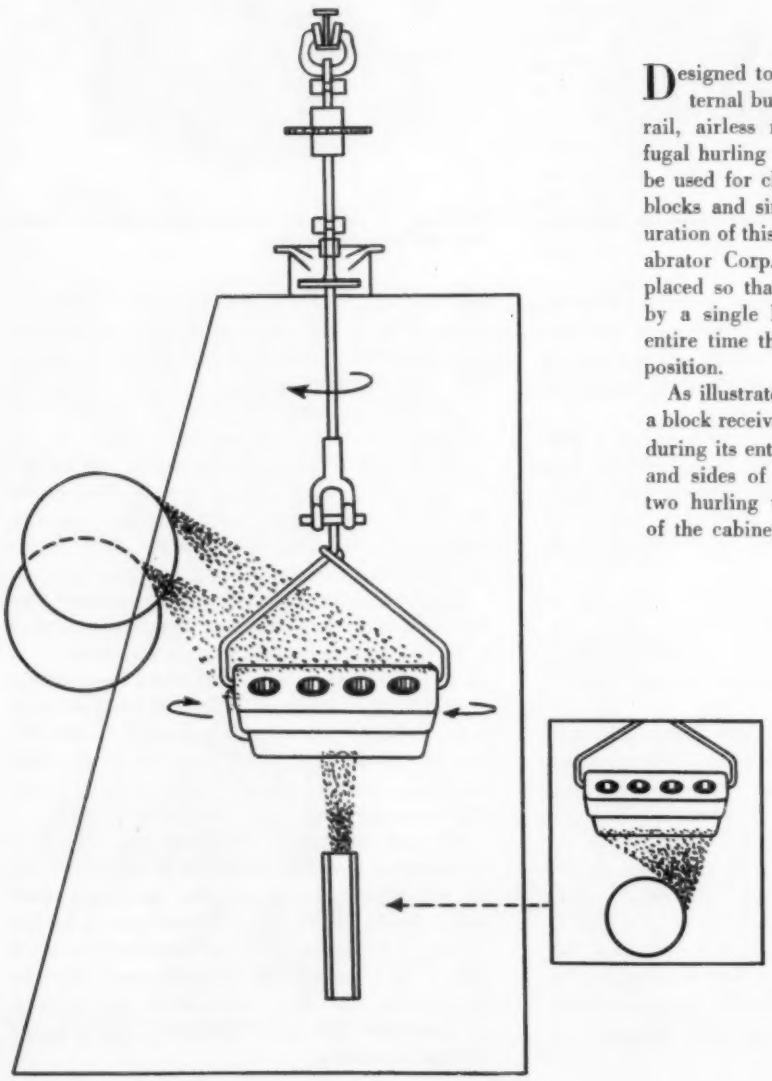
One note of caution should be remembered: a tool engineer should be certain he is willing to make the sacrifices that an executive admittedly must make. He shouldn't spend the better part of his life striving to be an executive and then finally make it only to find out too late that it wasn't what he wanted after all. Even with wealth and position tool engineers also want happiness. Don't be an unhappy executive.

designed for

PRODUCTION

CLEANING MACHINE

blasts parts with internal chambers



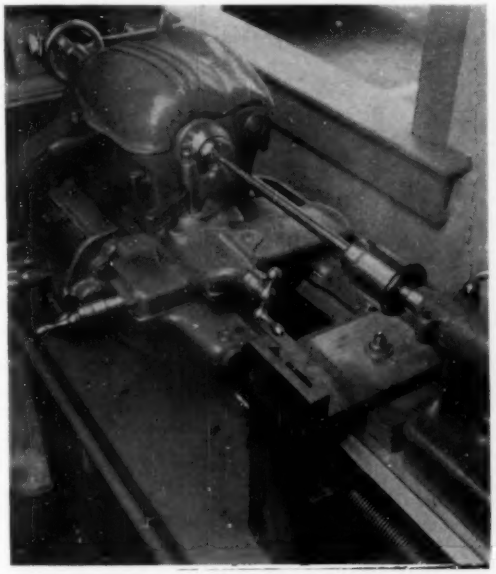
Designed to blast-clean parts with internal but open cavities, this monorail, airless machine uses few centrifugal hurling wheels. The machine can be used for cleaning automotive engine blocks and similar workpieces. Configuration of this unit, developed by Wheelabrator Corp., enables the work to be placed so that openings can be blasted by a single hurling wheel during the entire time the piece is in the blasting position.

As illustrated, the crankcase cavity in a block receives the blast from one wheel during its entire rotation. Valve section and sides of the block are exposed to two hurling wheels placed in the side of the cabinet.

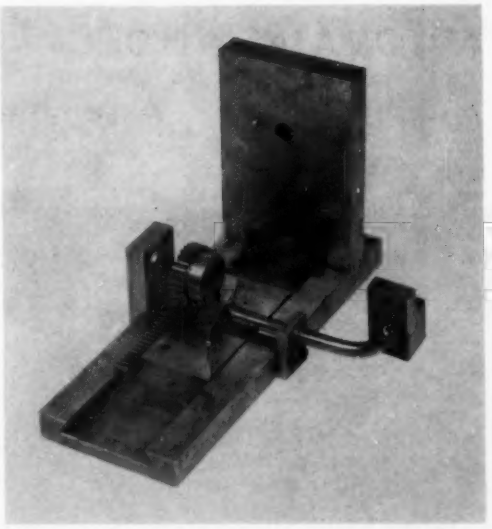
Lathe Attachment Cuts Nonlinear-Pitch Screws

Use of nonlinear threads has been limited because of difficulties in their production. A simple device, which can be applied to any lathe, has been developed at the National Bureau of Standards for production of such threads. Through use of a cam, the lathe tool is caused to traverse the workpiece at a nonuniform speed.

If a straight, pivoted bar is used instead of the cam in this attachment, it becomes another useful tool. By adjusting the slope of the bar and clamping it in place, it becomes a cam surface that permits cutting of screw threads for which gear ratios are not available on the lathe.

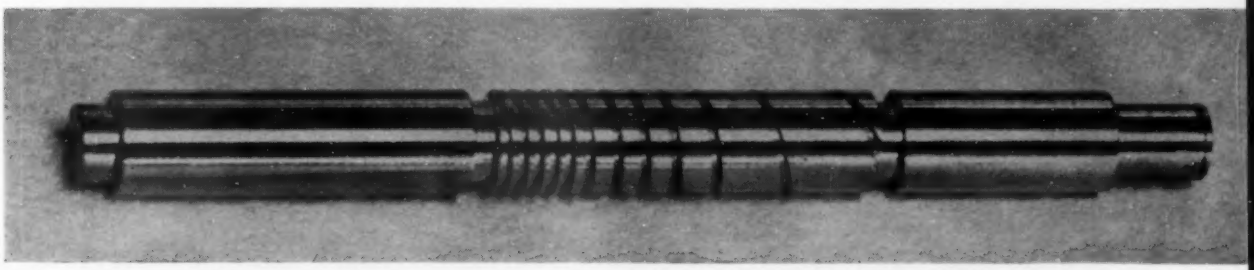


(Above) NONLINEAR screw-cutting device can be attached to a standard lathe without alteration of the lathe. It is often desirable, however, to remove the apron before the attachment is locked to the bed. The actuating rod block is fastened rigidly to the carriage.



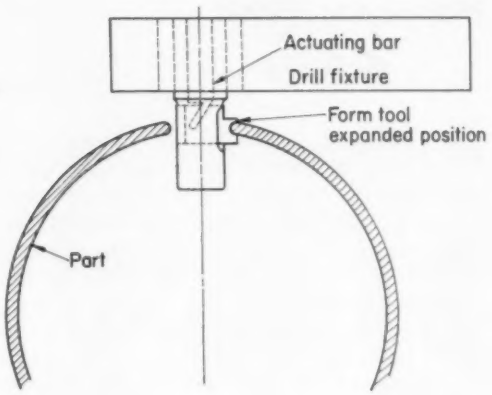
(Right) LATHE ATTACHMENT contains a sliding cam plate that moves vertically. The plate is driven up and down by engaging a rack with a pinion keyed to the lead screw of the lathe. The cam contour, fastened to the cam plate, moves upward at a constant rate, bears against the carriage through the rod and displaces the carriage sideways. Nonlinear motion of the carriage is controlled by the contour of the cam.

(Below) NONLINEAR-PITCH screw thread for use as drive screw in permeability-tuned rf inductors. This thread, about one inch long, is used in a radio receiver where the tuning dial has to be linear. To achieve dial linearity, the tuning slug must be displaced nonuniformly through the inductor coil.

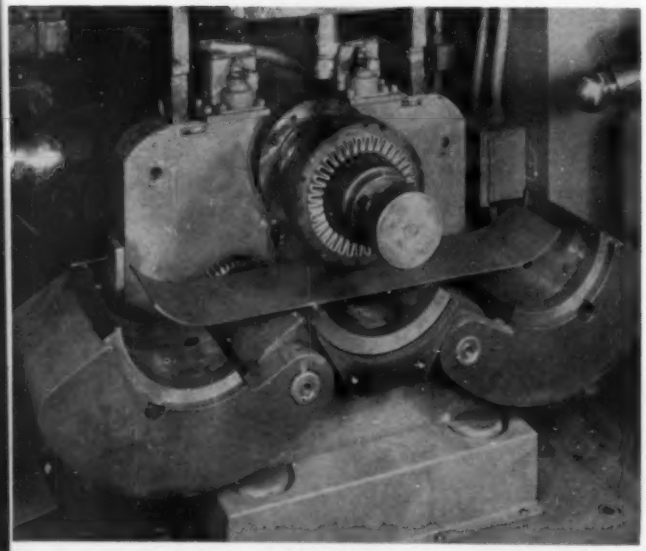


Expanding Form Tool Chamfers Both Sides of Holes

Holes in cylindrical parts can be deburred or chamfered easily by an expanding form tool used in a radial or standard drill press. The tool enters the hole collapsed and then is expanded to finish the edges. The chamfer can have an angle, form or radius, depending on the shape ground into the bit. True concave or convex surfaces can also be produced in hole edges with this tool developed by the Falcon Tool Co.



AUTOMATIC WELDER Assembles Stator Cores

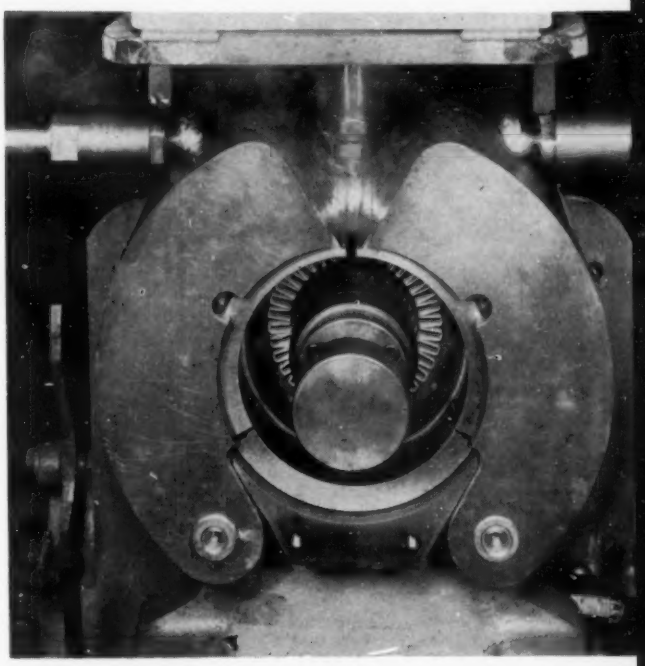


OPERATOR simply places a strip of flat steel with preformed ends under the wound stator core, which is held on a central mandrel, and presses the cycle "start" button.

Designed to reduce the time consumed in wrapping electric motor stator cores, a special automatic welder does the job in an average floor-to-floor time of 36 seconds. One of the chief problems tackled and solved by engineers of Standard-Modern Tool Co., Ltd., Toronto, Canada, arose when the stator design was modified from a completely round assembly of laminations to one with four flat surfaces. Purpose of the change was to economize on stock in production of the laminations. These flat surfaces produced a stator core assembly with similar flats, which was considered undesirable.

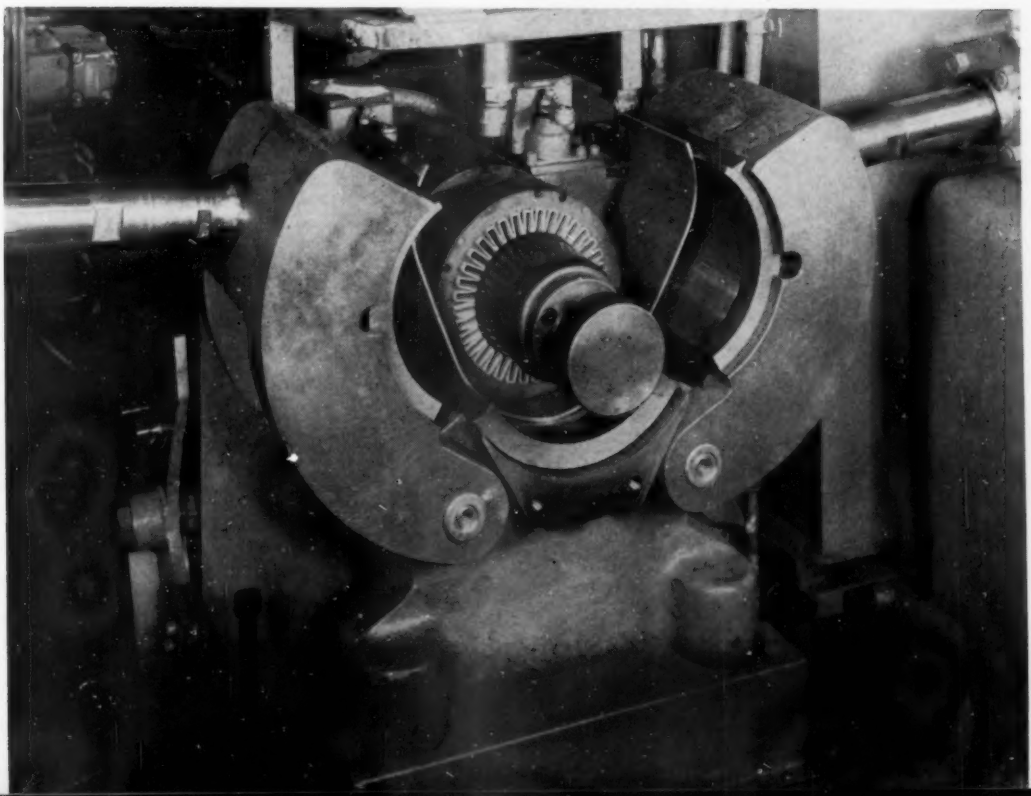
The machine, which was already constructed, was altered to include front and back forming rings on the central mandrel. The back ring has a reversed taper and is shot blasted to increase its coefficient

of friction. The front ring is chrome plated and tapered to reduce its coefficient of friction. These refinements permit removal of the front ring and subsequent hydraulic removal of the completed assembly from the rear ring. Tapers of 0.007 inch are incorporated to facilitate the difficult removal operation.



(Right) WITH AN INERT GAS shield and wire filler, the gap is then welded automatically. Shrinkage of the weld permanently binds core and shell together. Forming jaws then automatically release the completed assembly, which is removed by hydraulic means.

(Below) HYDRAULICALLY operated steel jaws wrap and clamp the strip around the core, leaving a gap of about 1/32 inch.

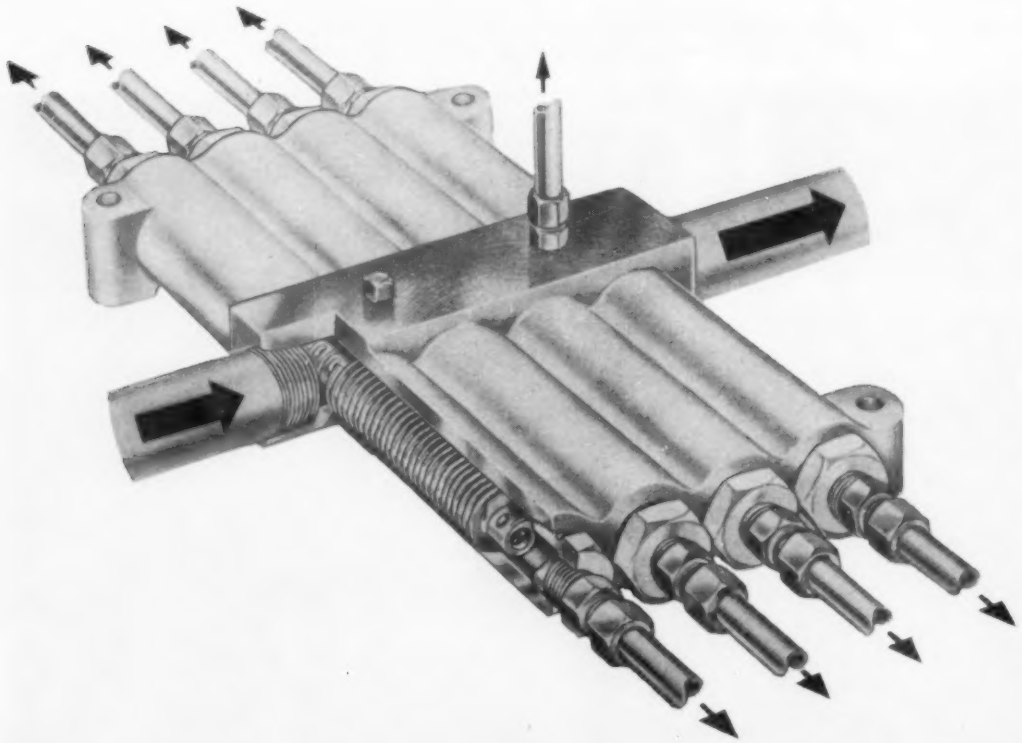


LUBRICATING OIL metered without restrictions

Based on a standard engineering principle, this metering device accurately and safely controls the flow of lubricating oil to various points of a straight-side press. Metering is accomplished by placing various length inserts, which resemble exaggerated screw threads, into the distribution lines from the manifold. At no point in the oil circuit is the passage reduced to less than the area of a $\frac{5}{32}$-inch tube.

This device, developed by Clearing Machine Corp., operates in accordance with the principle that if two tubes have the same diameter, more oil will pass through the shorter, under the same conditions, in a given period of time, This is due to internal friction within the oil and to friction between the oil and the tube wall.

OIL PASSES spirally through the metering block around the insert on its way to the lubrication point. The longer the insert, the less oil will pass through the block. The clear passages prevent clogging. Foreign material is flushed through the system and is then removed by the filter.



milling steel

how to get the most from carbide cutters

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Getting optimum performance when milling steel with carbines, the author explains, is the result of correct tool, fixture and machine design, as well as using correct grades of carbides and recommended feeds and speeds. Tool sharpening practices are also important.

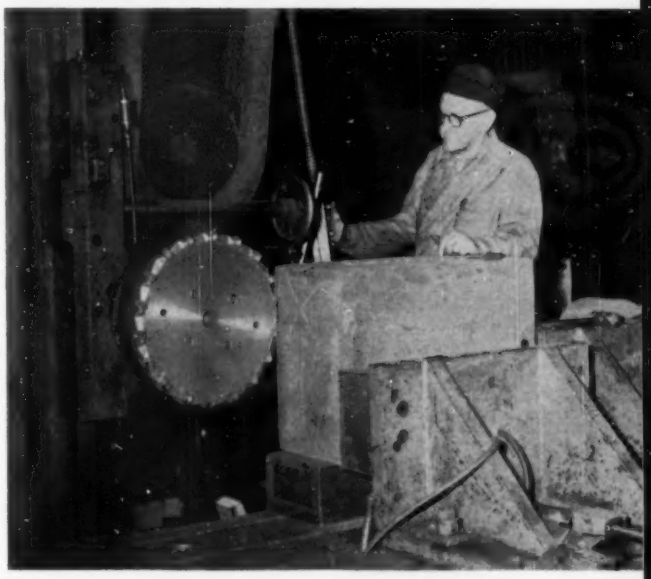

Fig. 1. Face milling a forged alloy steel die block with an 18-inch carbide-tipped cutter.

WHEN PROPERLY APPLIED, carbides can greatly increase the productivity of steel milling operations, *Fig.* 1. While the importance of selecting correct grades of carbide is generally recognized, there is sometimes a tendency to overlook other factors of at least equal importance. Even the best carbides cannot perform effectively unless proper cutting edge geometries are used. Fixtures and machines must be rugged and good sharpening practices can add significantly to tool life.

Cutter Design: Carbides used for milling steel must be capable of withstanding intermittent cuts through scaly surfaces impregnated with sand and have a relatively high resistance to crater and edge wear, with a minimum tendency to chip at the cutting edge. General-purpose carbides, such as those used for rough turning forged and cast steel workpieces, give the most satisfactory results.

Cutting edge geometries have been the subject of much experimental work. The use of a negative radial rake, a positive axial rake and a suitable peripheral cutting edge angle, giving, for example, a zero degree true rake in the direction of chip flow, has proved to be extremely effective in milling steel with carbides. Chips made by a cutting edge of this design develop into coils of uniform diameter and they leave the cutting edge in an outward radial direction, resulting in an unmarred work surface and relatively long cutter life.

Two methods of attaching carbide blanks to cutter bodies are in current use: brazing and mechanical fastening. Carbide blanks are frequently brazed directly to small diameter cutter bodies. Cast steel cutter bodies up to six inches in diameter with integral standard shanks give good results in service. They are rugged and the shank can be used for locating the cutter for sharpening, as well as in the milling machine, thus providing a true-running cutter.

For larger diameter cutters, several mechanical methods of attaching blanks to cutter bodies are

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widely used. In some shops, carbide blanks are wedged directly into the cutter body; in others, carbide blanks are brazed onto steel shanks or blades which are wedged into the cutter body. Cutters with indexable, solid carbide blades give outstanding results where maintenance of uniformity in cutter sharpening is a major problem. The square blades are clamped positively against accurate locating surfaces in the cutter body, permitting successive use of all eight available cutting edges before the blades require resharpening.

Machine Considerations: Due to their ability to operate at higher cutting speeds, carbide-tipped

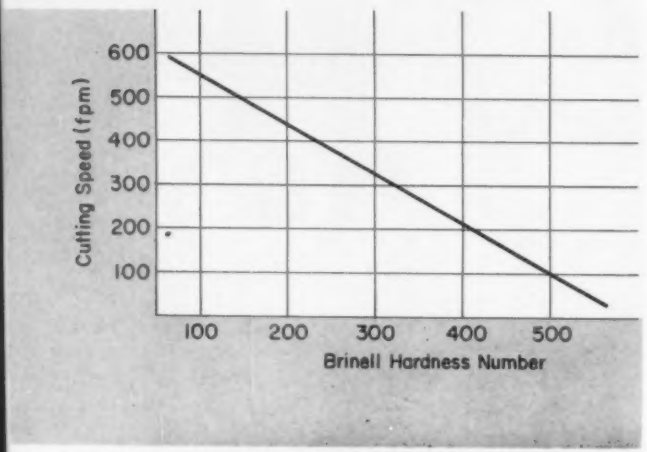


Fig. 2. Suggested cutting speeds for milling steel. These are starting speeds, and may have to be adjusted up or down to suit the requirements of specific operations.

milling cutters operating at the same feed per tooth as high-speed steel cutters can remove steel at feed rates which are five times faster. Drive motors of present-day machines equipped for milling with carbides have sufficient horsepower to obtain these higher feed rates. Machine spindles, driveshafts, gears and related parts are more rugged in design than those on machines designed for milling with high-speed steel. Bull gears are more massive and heavy flywheels are mounted integral with machine spindles to eliminate gear chatter and make the machines smooth-running.

Climb cutting methods result in longer cutter life when milling steel, because they provide uniformly thick chips for each tooth entry, rather than the zero initial chip thickness obtained with conventional milling methods. To obtain the full benefits of this improved cutter life, the lead screws of machines used for climb milling should be equipped with backlash eliminators to prevent the workpiece from being pulled into the cutter.

For heavy production where drive motors are loaded near capacity, it is always advisable to use a bed type, rather than a knee type machine. Bed type machines provide greater rigidity, which is necessary to eliminate chatter, maintain required tolerances and give the maximum number of pieces per grind.

Fixture Design: Properly designed fixtures are a necessity when milling steel with carbides. Workpieces should be located as close as possible to the top of the milling machine table and likewise as close as possible to the spindle nose side of the table to reduce the distance from the cutter to the spindle nose when arbors are used to drive the cutters. On horizontal milling machines, the resultant force of longitudinal and vertical cutting forces should cross the base of the fixture. When using horizontal machines, it is always advisable to clamp the workpiece downward and in the direction of feed. Thin and unsupported work sections in the area of the cut should be supported by an ample number of rigidly clamped spring plungers to eliminate vibration, which can cause chatter, reduce cutter life and impair finishes.

Occasionally, steel surfaces work harden when being milled with carbides. It is often assumed that the hardening is caused by the carbides. However, the hardening may be caused by any of several other factors. The material of the workpiece may be of a type which tends to work harden during machining, or there may be a light cross section in the workpiece which is intermittently crowded away from the cutter as a result of cutting forces. In the latter case, the induced vibration can result in work hardening. This condition can be corrected by proper fixture design.

The use of a sufficiently large arbor, an additional flywheel properly located on the arbor, or both, will

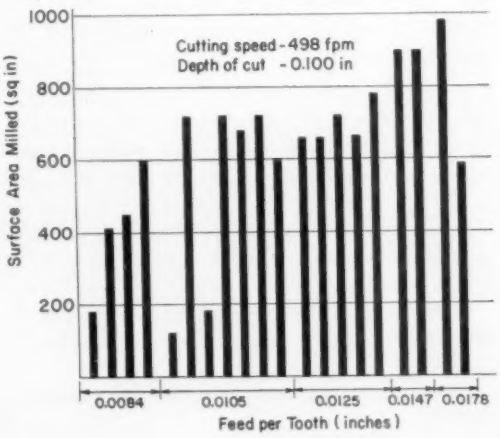


Fig. 3. (right) Test results showing relationship of cutter life and feed per tooth when milling with Carboloy grade 370. Most consistent cutter life is obtained in the 0.0125-0.0147 feed per tooth range.

eliminate torque vibration, thus reducing work hardening. The thicker chip obtained from the use of climb milling is also equally effective in reducing work hardening.

Another important consideration in fixture design is provision of means for cleaning chips from the fixture area as soon as they form. It is desirable to "streamline" the fixture so that chips flow by gravity from the milling area. Accumulations of hot chips heat the fixture and the workpiece, tending to affect dimensional control, and if the chips are allowed to gather on locating and clamping pads they will interfere with handling of the workpiece. Chips should not be allowed to accumulate in the area where the cutter teeth enter the workpiece, because pinching of a chip between the cutting edge and the workpiece may cause chipping of the cutting edge. Use of a wire brush revolving lightly against the cutting edge helps to keep chips out of this critical area.

If full consideration is given to all of the factors outlined, a carbide-tipped face mill can remove the full depth of cut in one pass. The resulting surface will be relatively flatter than a ground surface.

Cutting Fluids: Ordinarily, cutting fluids are not used when milling steel, since most of the heat developed from cutting is dissipated through the chips. Because of the short period of contact between the cutting edge and the workpiece, there is little flow of heat between the two. If there is too much heat to maintain dimensional control, however, a heavy flood of a light cutting oil, applied under pressure, can be used. This will carry away the objectional heat and help to maintain a uniformly high cutter life. Such a cutting oil will retain some heat and will not chill the cutting edges to an extent detrimental to the carbide. Additional protection against chilling can be obtained if a cooling system is used to maintain the oil at a relatively constant temperature. Under ordinary operating conditions, the use of soluble oil solutions when milling steel is usually found harmful to carbides because they subject the cutting edges to critical intermittent heating and quenching.

When cutting oils are used, adequate guards should be provided to prevent objectionable splashing. The guards should be designed to permit rapid changing of workpieces. If guards are not provided, operators tend to reduce the oil flow to an extent where cutter performance becomes erratic.

Cutter Grinding: One of the quickest means of determining the condition of a carbide-tipped milling cutter is to watch the chips as they leave the cut. Usually the inner side of the chip, the side showing the segment structure, is light blue in color. When a dark blue band, running in the direction of chip flow, appears on this surface, it is an indication that one or more of the cutting edges have been broken down and a warning that the cutter may require resharpening.

Care should be used in sharpening milling cutters. It is good practice to use a 60-grit silicon carbide wheel for grinding the clearance angle and a 220-grit diamond wheel for grinding the relief angle. The clearance angle should be ground first, removing both steel and carbide. A sufficient amount of stock should be removed in this operation to insure that the diamond wheel will contact carbide only when the relief angle is ground. If the diamond wheel contacts steel it will load up and generate localized heat in the carbide, causing thermal cracks

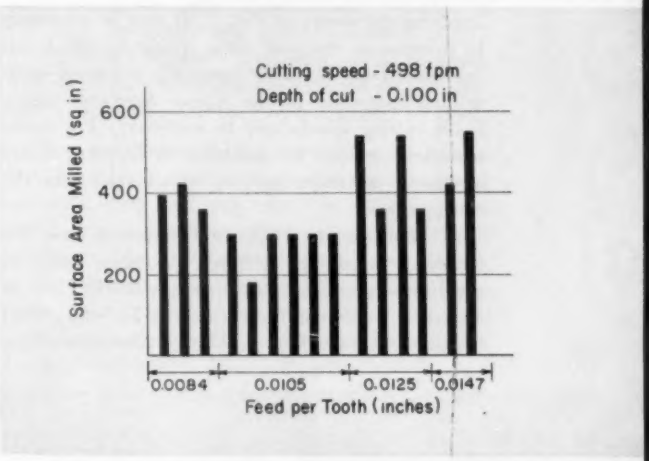


Fig. 4. Test with soft grade of carbide shows short cutter life, but length of runs is fairly consistent.

which are potential breakdown points when the cutter is in operation.

For good cutter life, not more than 0.0002 to 0.0003 inch of carbide should be removed with each pass of a diamond wheel, since cutter sharpening is a fixed grinding operation, and may cause heat checks to develop in the carbide. If the thickness and the cross-sectional area of the stock removed from each of the teeth is kept the same when grinding the relief angle, a true-running cutter will result, because the cutter pressure between the tooth and wheel remains the same. Grinding wheels should be kept clean and free-cutting by dressing them as frequently as necessary.

Cutter sharpening leaves a light grinding burr on the cutting edge after grinding the tooth face and relief angle. When the cutter is put into operation, projecting particles from this ragged edge are broken off by impact against the workpiece. The broken edge disintegrates rapidly. After the cutter is used for a short time, it takes on the appearance of having a wider than normal wear land, falsely indicating that the grade of carbide used was too soft.

Grinding burrs can be eliminated by lightly

brushing the cutting edge with a 320-grit silicon carbide hone. The direction of honing is parallel to the cutting edge and at an angle of approximately 35 degrees with respect to the tooth face. Honing produces a solid cutting edge which can withstand cutting impacts.

Speeds and Feeds: Cutting speed in milling should always be specified in terms of feet per minute rather than revolutions per minute. The cutting speed used for steel parts is always related to the physical properties of the material. This makes it advisable to determine the hardness of the steel to be machined before selecting a cutting speed. Suggested starting cutting speeds for steels of various hardness are shown in *Fig.* 2. It may be necessary to increase or decrease these speeds to suit actual job conditions. If longer cutter life is desired when milling materials in the higher hardness range, lower cutting speeds may be necessary. For softer materials, it may be desirable to increase cutter speeds to eliminate build-up of material near the cutting edge.

All table travels should be determined from the number of teeth in the cutter, the cutter speed in revolutions per minute and feed per tooth. There is always an optimum feed per tooth for every steel milling job, depending on the characteristics of the material being milled, uniformity of cutter sharpening practices and general operating conditions.

Generally speaking, light feeds do not result in optimum cutter life. As feed per tooth increases, the cutter life will also increase until the maximum feed at which cutter life is still consistent is reached. This is the optimum feed and, if feeds are increased further, cutter life will decrease rapidly.

The effects of feed rates on cutter life are illustrated by the results of tests made to evaluate Carboloy grade 370 as a steel milling material. A series of runs were made at several different feeds per tooth while using a constant spindle speed. Tests were made on the same setup used to determine feeds for milling cast iron, THE TOOL ENGINEER, October 1955, p. 92.

A No. 5 HM Kearney & Trecker vertical milling machine was used. An 8-inch diameter single-tooth fly cutter body was attached to an 18¼-inch diameter by 5⅞ inches thick sectional type flywheel mounted on the spindle nose of the machine. Total weight of the cutter-flywheel unit was 515 lb, providing smooth operation. Dimensions of the carbide tips were ¼ x ½ x ¾ inch. These were brazed to steel shanks, 4½ inches long by 1¼ inches square. Easy-Flo No. 3, plus copper shims, was used in brazing.

Two sets of shims were employed to accurately locate the tool bit in the cutter body. One set controlled the cutter diameter and the other determined the rake angles.

Workpieces consisted of 5 x 6 x 12-inch forged AISI 1045 steel billets which were hardened to a 190-210 Brinell hardness range. These were held in a vise while taking face milling cuts 5 inches wide by 0.100 inch deep.

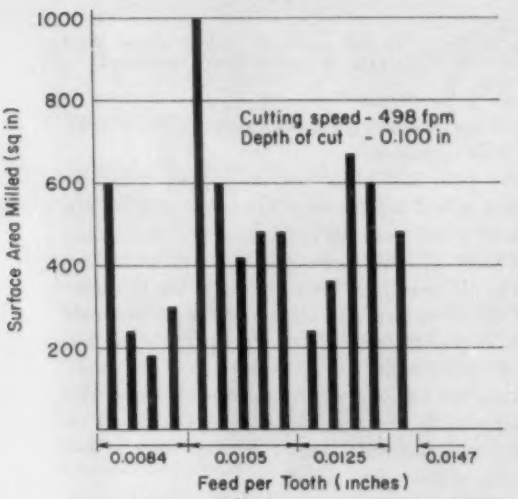


Fig. 5. The third grade of carbide tested showed a tendency to chip, resulting in inconsistent cutter life.

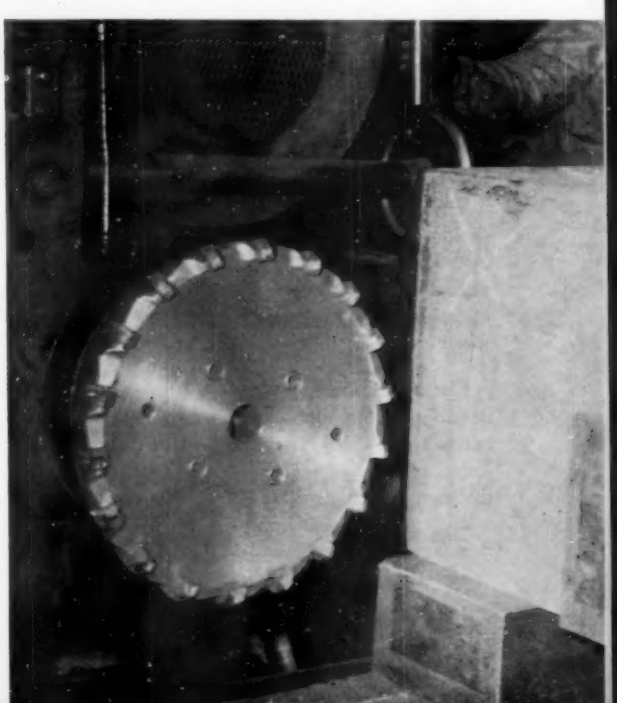


Fig. 6. Eighteen-inch milling cutter used to machine alloy steel die blocks.

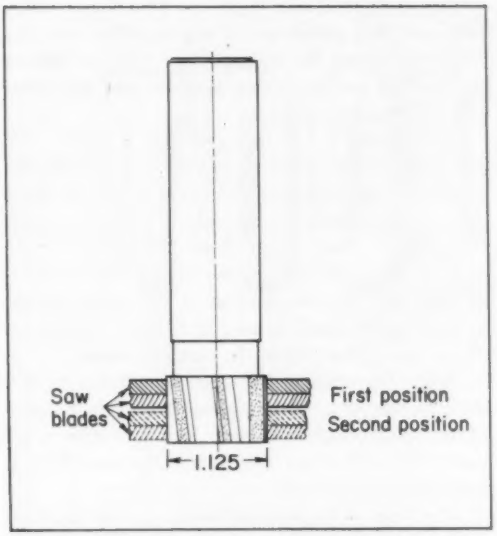


Fig. 7. Milling cutter for cutting gullets in six foot diameter circular saws. Area closest to the shank is used to mill one set of two saws simultaneouly; tool is then moved to a new position to mill a second set of saws.

Cutting angles were ground on a single-point tool grinder, following the practices described earlier in this article. Angles were as follows:

Radial rake	10 deg negative
Axial rake	10 deg positive
Peripheral cutting edge	45 deg
Corner (nose)	sharp
Face cutting edge	5 deg
Relief, peripheral cutting edge	5 deg
Relief, face cutting edge	5 deg

The measure of tool life was the number of square inches of surface milled before the tool became dull. Tools were considered dull when a 0.031 inch wide wear land was obtained along the peripheral cutting edge angle. When cutting edges chipped badly before the wear land had reached 0.031 inch, the number of inches milled up to that time was recorded as tool life. After each pass, the cutting edge was inspected and any breakdown or chipping of the cutting edge other than the development of the normal wear land was recorded. A sufficient number of runs was made to verify the reliability of the results.

Cutter life in terms of square inches of surface milled was plotted against feed per tooth in inches, *Fig.* 3. It is apparent from the graph that best results are obtained when operating in the 0.0125-inch and 0.0147-inch feed ranges. The chipping which occurs above and below that range makes cutter life erratic.

Tests made under the same conditions with softer grades of carbide showed that softer carbides wear more rapidly. Results of one test are shown in *Fig.* 4. Length of the runs was consistent, but much shorter than those obtained from Carboloy grade 370. There is an apparent tendency for the cutting edges to chip after they have become worn to some extent, when operating at the two higher feeds per tooth. A series of long and short runs was obtained from another grade of carbide, *Fig.* 5, indicating a tendency for the cutting edges to chip. Despite this tendency, the best operating range for this grade is at a 0.0105-inch feed per tooth.

An attempt to repeat the tests at 377 fpm, using the same feeds per tooth, was abandoned because an objectionable gear chatter developed in the machine. An analysis showed the 18¼ inch diameter flywheel was running at a peripheral speed of 1136 fpm when the 8 inch diameter cutter was operating at 498 fpm. To obtain chatter-free operation at 377 fpm, a 24 inch diameter flywheel would be required, with about the same mass concentrated near its periphery as used in the 18¼ inch diameter flywheel.

Shop Applications: Carbides are being successfully used for a wide variety of milling operations on steels. One such application is machining the matching or impression surface of forged alloy steel die blocks, *Fig.* 6. The die blocks are heat treated to a 388-429 Brinell hardness, leaving a tight scaly deposit on all surfaces.

Milling is done with an 18-inch diameter McCrosky inserted-blade face mill with 18 teeth. The blades are tipped with ¼ x ½ x ¾-inch blanks of Carboloy grade 370, which is a general-purpose steel cutting material. Cutting angles are a 10-deg negative radial rake, a 10-deg negative axial rake, a 35-deg peripheral cutting edge angle, a sharp corner or nose, a 3-deg face cutting edge angle, with a 5-deg relief on the peripheral cutting edge angle and a 3-deg relief on the face cutting edge angle.

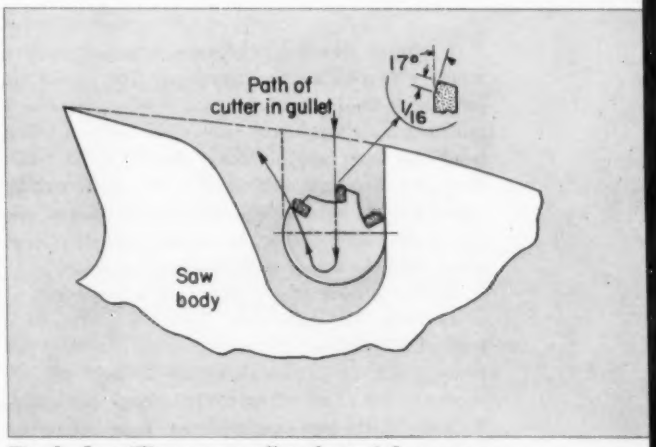


Fig. 8. In milling a saw gullet, the tool first cuts a slot, then follows the contour of the gullet.

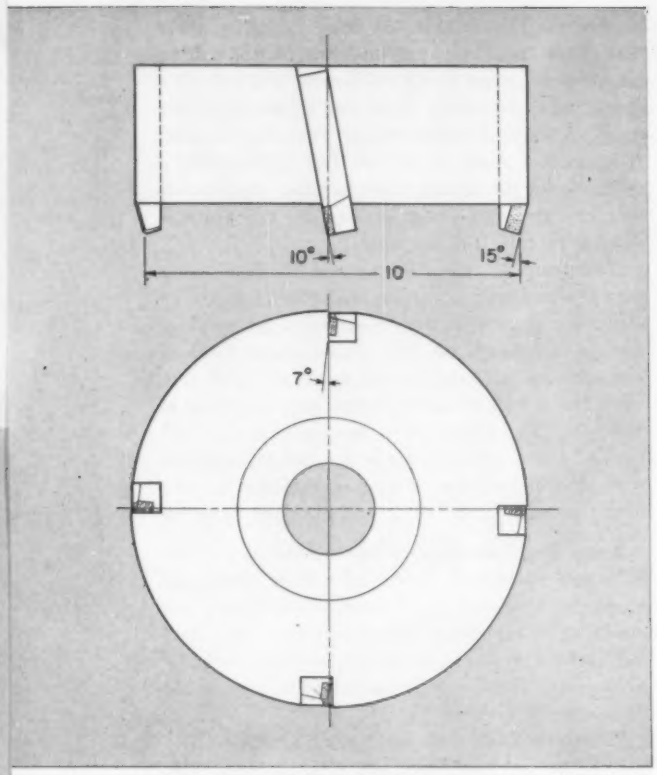


Fig. 9. Specially designed cutter for milling large steel weldments.

A special traveling-head type Ingersoll milling machine is used for the operation. The blocks are held in a 90-deg included angle magnetic chuck mounted on a stationary table. The entire milling head unit feeds longitudinally, parallel to the table. Both the direction of feed and the climb cutting action tend to hold the die block in a pocket at one end of the chuck during the milling operation, supplementing the action of the magnetic chuck.

Milling is done at 160 sfm, with a tooth feed of 0.013 inch. The face mill illustrated machined a total of 250,000 square inches of surface and was resharpened 24 times, giving an average of 580 square inches of milled surface per blade per grind. A total of 0.013 inch of carbide was removed during each grind, reducing the final dimensions of the blank to $\frac{1}{4}$ x $\frac{3}{16}$ x $\frac{5}{8}$ inch.

In another plant, a 1.125-inch diameter straight shank profiling end mill is used to machine gullets in six-foot diameter wood saws, two saws at a time. The machine is a special Cincinnati rotary Hydro-Tel machine, equipped with a 7½-hp motor. The saw bodies are of AISI 1095 steel, having a 444-514 Brinell hardness range and a clean surface.

The profiling cutter, furnished by the Nelco Tool Co., is made by brazing six $\frac{1}{8}$ x $\frac{3}{16}$ x $\frac{3}{4}$-inch Carboloy grade 370 blanks to a steel body at a 7-deg negative axial rake angle and zero degree radial rake, and then grinding a 17-deg negative land, $\frac{1}{16}$ inch wide, along the cutting edge. Chrome plating on the flute surface resists abrasion and facilitates exit of chips from the cut.

Cutter speed is 135 fpm and feed is 0.0063 inch per tooth. Compressed air is used as a coolant and to aid in removing chips. Length of the profiling cutter is sufficient to permit making cuts in two positions, *Fig.* 7. The portion of the cutter closest to the shanks is used to mill one set of two saws simultaneously, and then the portion of the cutter farthest away from the shank is used in milling a second set of two saws. The path of the cutter is shown in *Fig.* 8. A slot the width of the cutter is milled first, and then, as part of a continuous operation, the balance of the gullet profile is milled. This operation is repeated for each of the 60 gullets in the saw. Milling and indexing are automatic.

After two sixty-gullet profiling operations, producing a total of four saw bodies, the cutter is considered to be dull. Not more than 0.001 inch of carbide is removed from the cutter diameter during milling. The cutter is resharpened in eight 0.005-inch diameter increments, to suit a set of cam followers, representing the total cutter life.

A recent problem faced by a west coast manufacturer was the milling of large workpieces fabricated from welded steel plates. Rough and irregular burnt edges created machining difficulties. Initially, carbide-tipped face mills were used, taking cuts 10 and 14 inches wide and 3 to 4 feet long, with a ¼-inch maximum depth of cut. Operations were performed on a Lucas horizontal boring mill equipped with a 7-inch spindle. Owing to excessive blade breakage, it was necessary to temporarily discontinue the use of carbides for the job. To solve the problem, the company made its own 10-inch diameter carbide-tipped inserted-blade face mills, *Fig.* 9. This was done by mounting four brazed single-point tools, tipped with Carboloy grade 370, in a steel body adapted to the spindle of the Lucas machine. Cutter teeth were sharpened to a 7-deg negative radial rake, a 10-deg negative axial rake, a 15-deg peripheral cutting edge angle with a $\frac{1}{16}$-inch radius on the corner and a 5-deg relief angle all around.

This cutter is operated at 500 fpm and 0.008-inch feed per tooth. To obtain improved operating conditions for the increased feed rates, the 20-hp motor on the machine was replaced with a 30-hp motor. The net result of using the special carbide cutters was a 60-percent reduction in machining time.

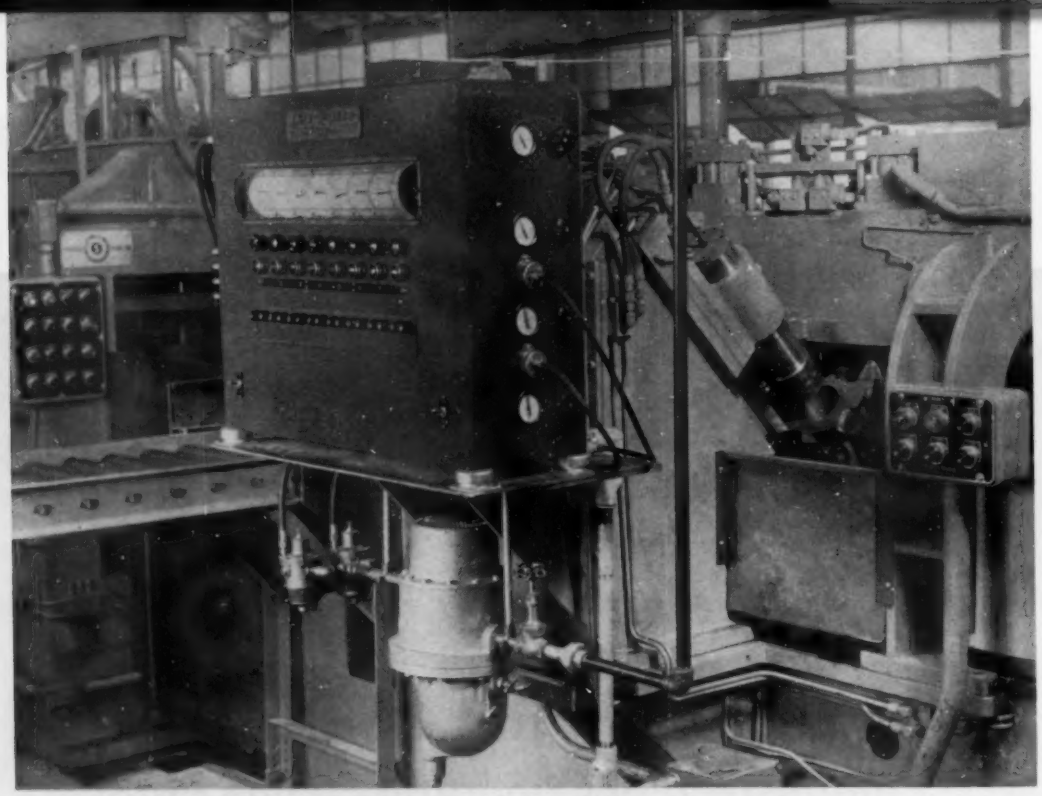
These case studies exemplify the results that can be obtained from correctly used carbide tools when milling steel. Such results can be obtained consistently if all of the factors affecting cutter performance are taken into account in planning steel milling operations.

TOOLS at work

Productivity and Quality
Emphasized at Canadian Engine Plant

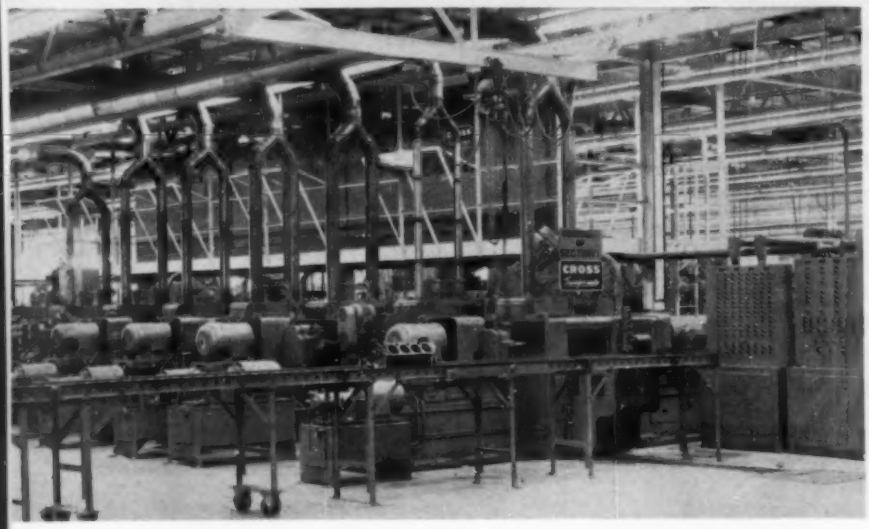
Good layout, extensive automation, conveyorization and automatic in-process quality control contribute importantly to the over-all efficiency of the recently completed engine plant of the McKinnon Industries, Ltd. in St. Catharines, Ontario. Both Chevrolet and Oldsmobile engines are assembled and tested in the plant, which also houses the machining operations for the Chevrolet engine. Total floor space is 365,000 feet. An adjoining foundry, with 400,000 square feet of floor space furnishes rough castings for engine components.

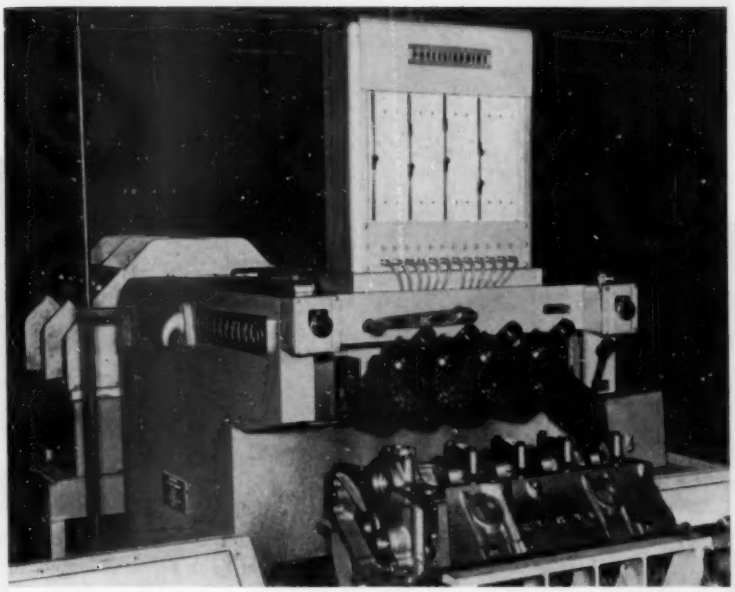
Layout of the one-story plant is unusual in that the final assembly line runs through the center of the plant, rather than being along an outside wall. All machining and feeder lines are oriented so that the flow of components is in the direction of the assembly line. Bulky components, such as engine blocks and cylinder heads, are carried directly to the assembly line by conveyors. Following assembly, engines are transferred from the assembly conveyor to an overhead monorail power-and-free type conveyor which carries them through balancing, painting and hot testing operations to the shipping dock. Thus, there is a continuous flow of components from receiving areas through all machining and assembly operations to shipping.



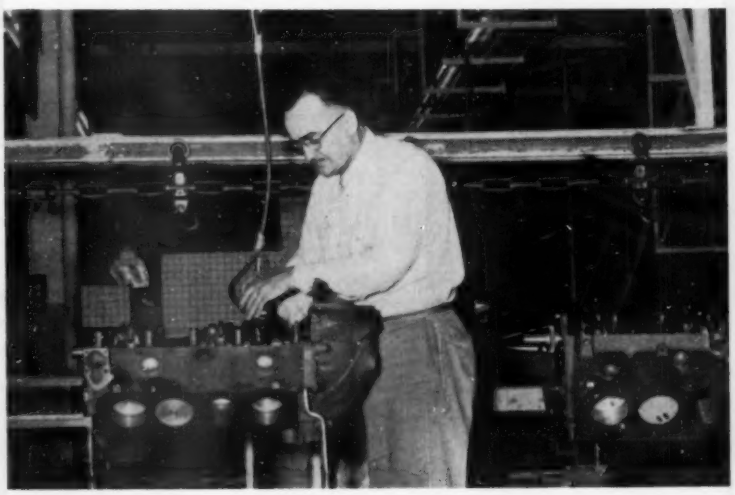
TYPICAL OF THE automatic in-process quality control devices in the plant is this combination air-electric gage which measures the diameter of cylinder bores. The gage is an integral part of a 22-station transfer machine, and prevents the machine from cycling unless the bores are within the specified tolerance. A light on the gage panel indicates which bore does not meet specifications.

"SECTIONIZED AUTOMATION" is featured in the transfer machine for engine blocks which contains five sections performing a total of 555 metal-cutting operations: 265 drilling, 6 milling, 21 boring, 56 reaming, 101 countersinking, and 106 tapping. Production at 100 percent efficiency is 100 pieces per hour, with 104 pieces in process at any one time. Primary transfer units move blocks within each individual section simultaneously, and secondary transfer units move blocks between sections while machining heads are cycling. Since the sections cycle independently of one another, any one section can be stopped without interrupting the cycle of the others. An extensive dust-collection system improves working conditions and housekeeping. Chips are carried away by an under-floor conveyor system.



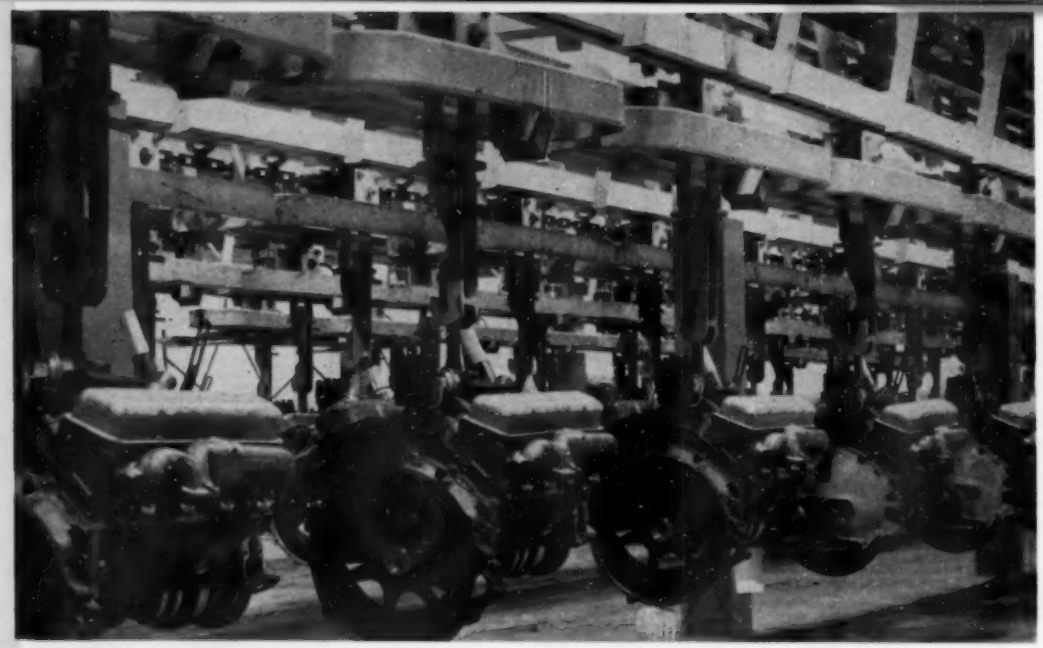


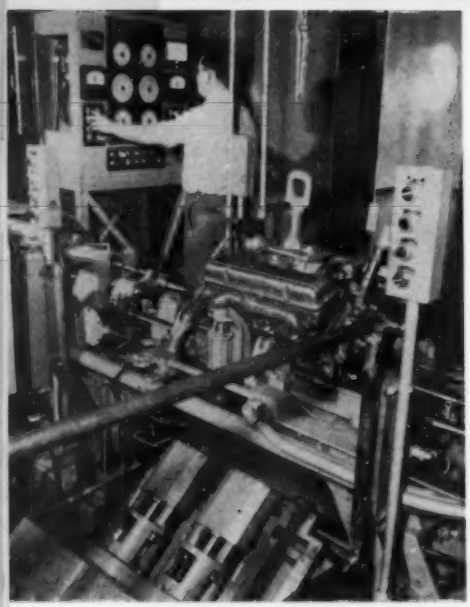
AN AIR GAGE is used to check cylinder bores for taper and out-of-round conditions. It also segregates and grades bores according to diameter, using 0.0002-inch increments. The grade is stamped onto the pan rail to facilitate selective fitting of pistons, which are also graded by diameter.



FINAL ASSEMBLY is accomplished on pedestal type fixtures. The conveyor track is covered so that the assembly operator can walk around the fixture safely and traffic across the assembly line is not impeded. Portable air-powered tools are used wherever possible to facilitate assembly work.

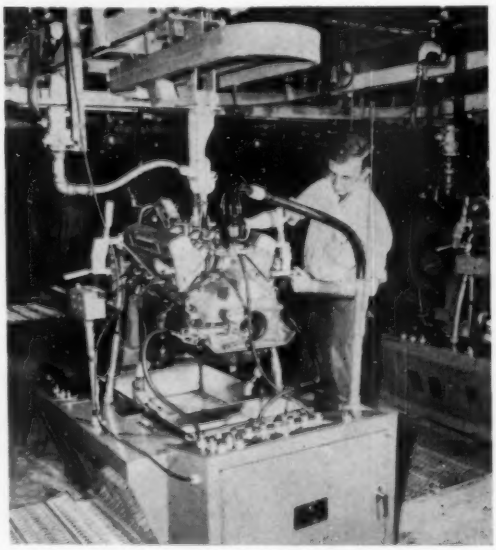
TOOLS at work





ENGINES are suspended from carriers on the power and free conveyor by means of a special hook which is bolted on at assembly. A selector dial on the carrier makes it possible to shunt engines into any one of 17 interconnected conveyor sections for painting, hot testing, repair or in-process storage. After final inspection and approval, engines are routed to the shipping dock, where they are placed on special racks for the trip to final assembly plant.

PROPANE FUEL is used in hot testing completed engines, which are not removed from the power and free conveyor. The engine is started by its own starting motor. Average running time is ten minutes, during which the operator adjusts the timing, makes any other necessary minor adjustments and checks for leaks. Water and oil used for testing are continuously circulated through filters to remove contaminants.



BALANCING of the complete engine is done on an automatic electronic machine developed by General Motors Research Engineering. An electric motor is used to rotate the crankshaft at operating speed. Out-of-balance is read from indicating dials by operator, and the degree of correction required is calculated automatically. When rotation is stopped, drilling heads remove a sufficient amount of metal from the crankshaft to correct the out-of-balance condition. The crankshaft is then rotated again to make sure that proper balance has been achieved.

TOOLS at work

AUTOMATIC ASSEMBLY

victory for productivity

By Ralph H. Eshelman
Associate Editor

One of the last frontiers for achieving significant cost reduction is through automatizing of the assembly line. This article evaluates present practice, and discusses general principles and basic considerations. Manufacturing managers and tool engineers who have questions of the when, where and how of automatic assembly will find this survey especially helpful.

TODAY, THE METALWORKING industry is on the threshold of a momentous advance in the production process, as far-reaching as Henry Ford's conception of the moving assembly line. Even in the automotive industry, which has often been the bellweather of metalworking automatic assembly operations have lagged behind applications of parts manufacture and particularly machining. There are many reasons for this, some of them technological and some economic. Yet for some time it has been apparent that the engineering skill and knowledge have been available to improve assembly operations. The economic climate has become ripe for the attempt to overcome the many problems involved, and they are considerable.

Outstanding successes have been attained in making assembly operations automatic, *Fig.* 1, in a wide variety of industries and a range of parts, which will be described in this and a succeeding report. The breakthrough has been achieved. The next step is for industry to exploit the almost limitless potentialities of automatic assembly.

Thus, mounting interest has focused recently on the intriguing possibilities of applying new techniques to assembly line operatons. However, several historic examples can be pointed out, especially of small parts. Some of them are long standing. For instance, the electrical industry has automatically assembled light bulbs for many years. Sealing of cans and bottle capping are other examples. Others could be cited, such as many spot-welding and projection welding operations in appliance, automotive and other fields.

One of the first jobs on automotive assembly lines to receive attention, when manufacturing management begins to consider greater mechanization, is nut-running and tightening bolts. Hand tightening results in uneven torquing. Portable, motor-driven torque machines are faster but are heavy and produce little better results. Automatic torquing is the logical next step and involves only

comparatively simple problems of positioning and indexing, since the bolts or nuts can be started by hand. Ford Motor Co. was one of the first to adopt nut torquing machines and use them in tightening cylinder head bolts in engine assembly.

Automatic machines have been installed for pressing in dowel pins, tightening connecting rod cap bolts, *Fig.* 2, as well as other similar jobs on the Pontiac engine line. The Chrysler engine div. uses automatic nut torquing equipment more extensively than has been done heretofore, on its new engine line. So this process has been accepted as conventional practice in the mass production field.

In the aircraft industry assembly problems are even more complicated than in the automotive. One operation that is repetitive on a wide variety of parts and could be standardized is riveting. Increasing precision requirements of high-speed aircraft design made some improvement in hand riveting almost mandatory. The result is automatic riveting, *Fig.* 3, which is rapidly being accepted as standard practice.

From this infant's creep, progress in automatic assembly is now at the walking stage and is accelerating as experience grows and general principles are discovered. As a result of this survey, it can be revealed that some really spectacular installations are on the boards and in various stages of tryout, which will make history in production. The impact will be fully as great, if not greater, as that of the transfer principle on production machining operations.

Prime incentive for management in considering the investment required for automatic assembly is the potential cost savings, of course. This depends on many factors and often direct labor involved may prove one of the less important items. Automatic assembly frequently offers an opportunity for greater precision or quality in the end product, a reduction of scrap and rework costs, greater safety for operators as well as increased output. In one case scrap and rework costs of a small, mass production item were high because of the precision required, with rejections running as much as 15 percent. By use of automatic gaging and selective mating of parts an automatic assembly process has been designed which will reduce this to practically nil, *Fig.* 4. Major elements of this assembly, as shown, are a piston and mating cup. The fit between them must be within 0.0002 inch so that when filled with oil a hydraulic cushion is provided upon

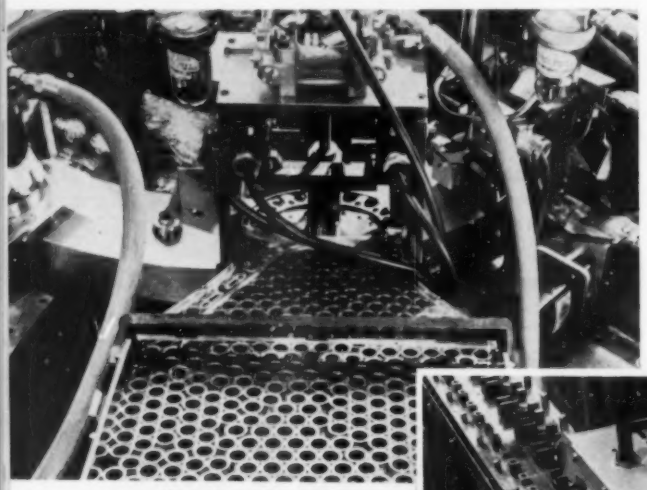


Fig. 1. (above) Tray feeds small metal can to index wheel in battery assembly machine designed and built by Multra Corp. Air-operated plunger transfers the part from the feed wheel into the subassembly.

Photo courtesy Cleco Div., Reed Roller Bit Co.

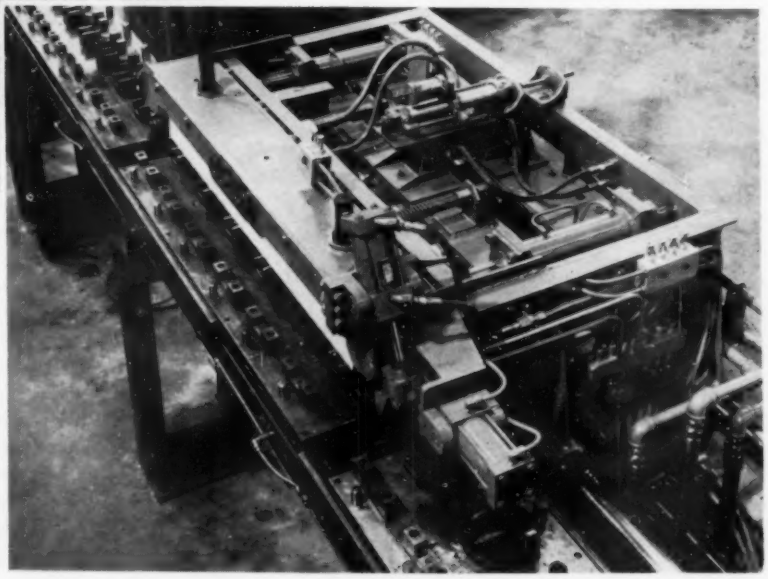


Fig. 2 (right) Tooling of nut setter for connecting rod cap bolts provides simple but positive location. Six rods are loaded on each pallet (shown unloaded). Entire unit is indexed to position for tightening of all bolts simultaneously.

which the proper function of the part depends. In station number one the piston is gaged and classified into one of 20 size categories of 0.000025 inch each. Parts beyond tolerance at either end are rejected. Good parts are directed to storage magazines, one for each category, for later selection.

At station two the cup is gaged to determine if it is within the over-all limits. If so, the part then goes to a second station where it is gaged for the proper mating fit and the information is sent to a memory wheel. This syncronizes the selection and feeding of the mating piston so that both parts arrive at the assembly station simultaneously.

Estimating Costs

Because of the lack of an extensive background of experience, estimating probable costs of an automatic assembly installation is difficult. Yet a prudent management will be insistent on the most accurate estimate possible before committing itself to the extensive investment usually involved.

Several systems are in use, which attempt to find an answer to this dilemma. Recently Robert Dexter, chief engineer of Barkeley & Dexter, Inc., proposed a rather complicated formula for determining costs of special assembly machines. This formula is based on the number of detail drawings and parts required in the assembly machine. Another method is used by several GM divisions, which have considerable experience with special assembly machines for electrical automotive parts. They give a proposed project intensive preliminary study. This is based on an evaluation of the present method, and comparison of the proposed process by methods engineers with plant layout, costs of automatic controls, possibilities of utilizing standard components, and need of retraining operators and maintenance personnel, considered in light of manpower requirements.

Several important factors must be given consideration in analyzing an assembly operation for possible automation. As with any installation involving expensive automatic equipment, production quantities and length of run are major considerations. Economic justification of automatic processing requires that parts to be assembled be reasonably free of radical design changes, at least over the period of amortization of equipment. Many companies set this period at one or two years. Based on these considerations, products such as bearings are particularly adaptable to automatic assembly, since they are built in standardized sizes and great quantities with few design changes from year to year.

As a result, manufacture of bearings is now almost completely automatic, especially in the more common sizes. In some bearing manufacturing plants the cups and cones are produced automatically with gaging controls such that the cup sizes and cones are measured and the exact ball size selected to provide a precision assembly. In the operation the desired number of balls of proper size are counted out from their hopper. They are then stored at a station to be automatically loaded in the races which have been under similar control. In succeeding stations a check is made automatically to determine that a full complement of balls has been inserted in the bearing and properly oriented. Following this, the balls are separated and one half the separator is inserted. The subassembly is then checked and rejected if incorrect. Next the second part of the retainer is inserted and staked. The completed bearing is again checked and good ones are transferred to the packaging area. The numbers of rejected bearings are reported to be very low in this type of process.

One reason it is economically feasible to build this type of equipment is the fact that these parts are practically free from engineering changes. By contrast, even if technically practical, it would be unsound at present to invest in assembly machines for such products as automotive bodies because of the many changes each year, and also the many models produced. This leads to the suggestion that there may be many subassemblies that might be considered for continuous automatic production, although the final product itself might be unsuited.

In this regard Howard Roat, director of production engineering at AC Spark Plug, offers some

Sketch courtesy General Riveters, Inc.

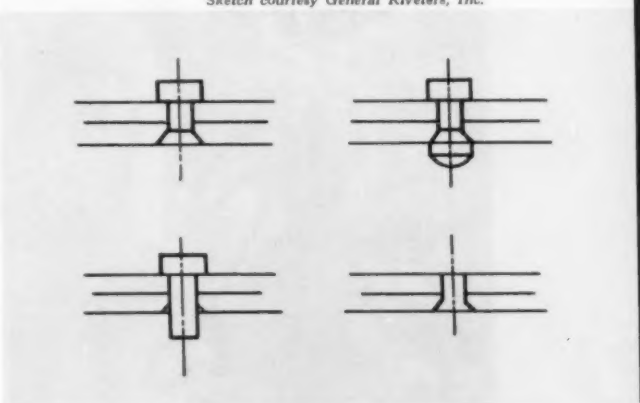


Fig. 3. Typical automatic riveting operation: (1) drill and countersink hole; (2) insert slug from top of work and squeeze bottom; (3) swedge top side of slug; (4) shave head.

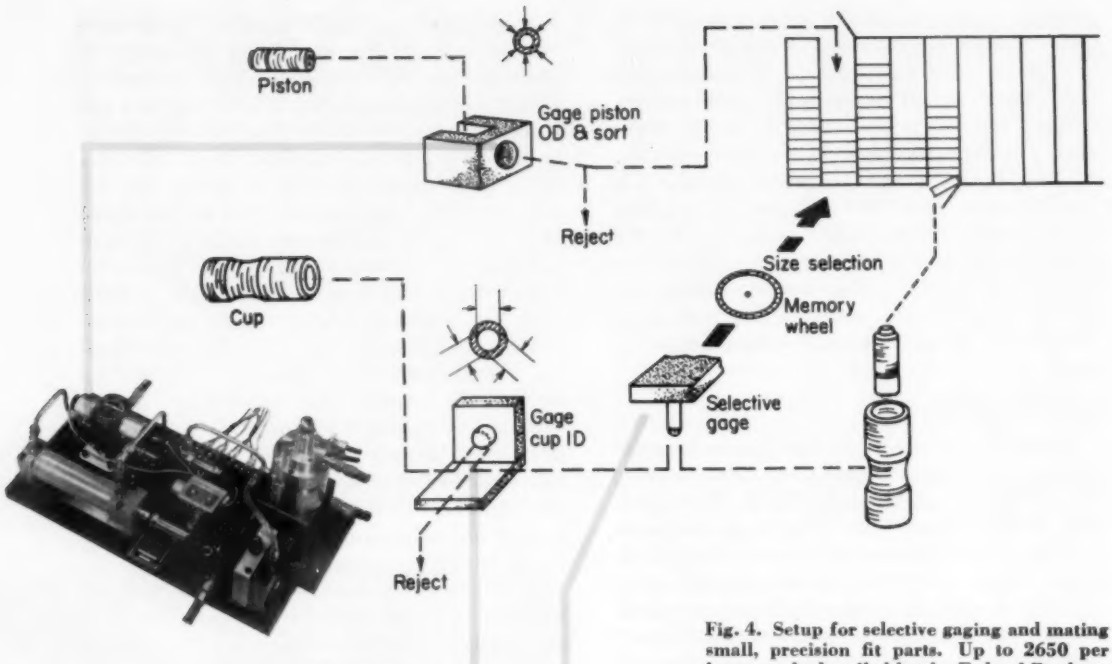
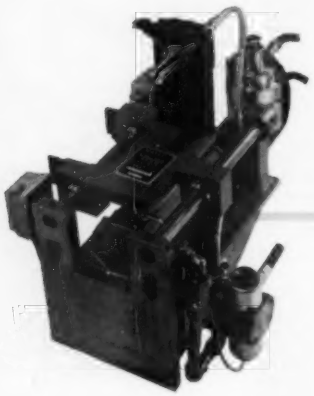
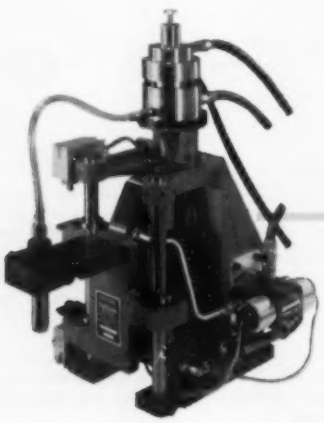


Fig. 4. Setup for selective gaging and mating small, precision fit parts. Up to 2650 per hour can be handled by the Federal Products Corp. unit.





yardsticks which may be used: (1) Are several operators performing the same operation? (2) Does the job involve difficult and continuous handling operations? Is it a production bottleneck? (4) Are there a high number of rejections due to the human factor? (5) Are there involved inventories due to the large number of in-process parts? The presence of one or more of these signs is no final indication that automatic assembly would be justified, but rather points to an area for further study and possible development.

As every engineer in manufacturing is well aware, meeting the established requirements of the product design with a practical and economical production process frequently poses a real paradox. The fact that product design has often been paramount in the past may have been one of the factors in retarding automatic assembly. As Ralph Cross has pointed out, for successful automation the method of assembly, as well as parts manufacture, must be taken into consideration at the inception of design. Many parts being assembled by hand are unsuited to automatic assembly because no means can be provided for mechanical handling, orienting or holding.

Moreover, in hand assembly, many incidental choice-making tasks are performed by the operator, that are not commonly realized, such as minor in-

spection, removal of flash, rejection of bad parts or fasteners, other minor rework and selective fit. To be successful a machine must in some way replace these human skills, either by gaging or some form of control. The process development staff at GM Tech Center, which is doing outstanding work on assembly processes, reports, for instance, that they find one of the most troublesome problems is the variation in commercial fasteners and standard parts. An automatic machine is quickly halted by a variation in rivets, for example, which would cause no difficulty in hand assembly.

Utilizing Gaging

In automatic assembly, gaging becomes much more critical. Automatic control must provide for inspection as well as many of the incidental operator functions. From their experience with these problems, gaging engineers have advanced the axiom that a plant making full use of control gaging potential would have only the correct size parts fed to succeeding operations. This implies 100 percent inspection of all parts going into an assembly. Fortunately, practical inspection may be achieved in many instances by means of hoppers which feed the parts. By ingenious design, only satisfactory fasteners will feed through; others are rejected.

In gaging parts for assembly, two methods are widely used. The first is in-process control in which gages hold the parts to fine limits in machining. This system may not always be feasible or economic. For this reason selective fits are often employed with post-process gaging utilized to sort the parts into various classifications, as discussed previously. The process planner must decide which technique fits his equipment and process and will be most practical and effective on specific operations in his plant.

In relation to the basic problem of design of parts and product for automatic assembly, some really advanced thinking is represented in the concept of modular design. This approach, which utilizes small standardized units as building blocks, has been strongly advocated by the National Bureau of Standards. The purpose of the developmental program, termed "Project Tinkertoy, (THE TOOL ENGINEER, p. 71 of Dec. 1953,) is to provide a means for shortening lead time on production of electronic equipment. A manufacturing system was developed on a pilot scale for automatic fabrication and assembly, *Fig.* 5. This is based on the design of electronic equipment which is built up from small standardized modules of the printed circuit type. These modules replaced conventional parts such as resistors, capacitors and wires which must be assembled by conventional hand methods.

This integration of design and manufacture might be considered an ultimate goal. In any event, it proved highly practical in the pilot application. The system known as Autofab and similar techniques in the electronics industry based on printed circuit units are really an adaptation of this theory. While many tool engineers may feel they are in no position to utilize this concept on a commercial basis as yet, undoubtedly the time is rapidly approaching when the method of final assembly or fabrication will influence product design in initial stages. Intensity of competition and continued rise in manufacturing costs will assure this.

Another basic problem, and one which has hampered development, is the fact that each installation is a custom job and development costs cannot be spread over several manufacturers as has been possible, for instance, in transfer equipment for the automotive industry. As a result, many of the automatic assembly installations now in use represent special developments of laboratories of large manufacturers.

A development which exemplifies this trend is the torus assembly machine now in operation at Detroit Transmission Div., GM, *Fig.* 6. Vanes are loaded in slots in the torus shell in a previous opera-

Photo courtesy National Bureau of Standards

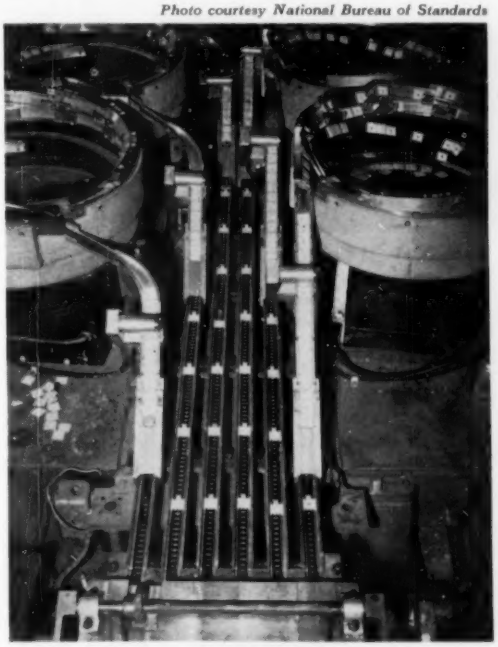


Fig. 5. Ceramic wafers are fed into printing unit to add circuit element. These "modules" then pass into assembly machines which combine them to produce electronic equipment.

tion and this subassembly is placed on a pallet by an operator at the first station, as are also a hub and spacer. At the next station, in line rivet holes for fastening the assembly are drilled, probed and deburred. An unusual turntable, *Fig.* 7, then reverses the direction of travel of the pallet and assembly. Next comes a chip-removal operation; then rivets are loaded by an ingenious set of fingers which open to accept them, then push them into position in the assembly, as depicted in the cover illustration. A probe determines that this operation has been completed properly, *Fig.* 8. Rivets are headed automatically. After this an operator loads the inner shell which is automatically pressed to position. To fasten the vanes, tabs are mechanically spun over on the outer shell in a succeeding station. Following this the inner shell is crimped with vanes

Photo courtesy Detroit Transmission Div.

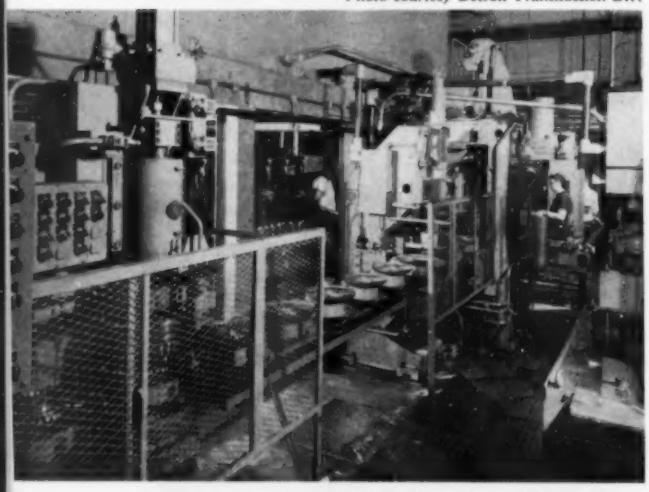


Fig. 6. Torus assembly machine developed by Process Development Section, GM Tech Center combines a variety of special machines for mechanized operations on an oval track. Major parts are loaded manually.

bent to the proper angle. Finally the assembly is gaged automatically and the information is relayed to the final eject station. Tooling holes are plugged; the direction of travel is again reversed by a walking beam turn-around and the completed torus is ejected at the final station. This station automatically sends it on to the balancing machine or out the reject chute for rework.

To conceive and develop an integrated assembly operation such as this obviously involves a high order of production engineering. In addition to familiarity with basic machine tools it necessitates intimate acquaintance with gaging and sensing devices, automatic feeding principles and tooling methods. Beyond these, an inventor's creativity is required to solve the unique problems always posed by the first machine of its kind.

Integration on Machining Lines

Such case studies indicate that the engineering is available to overcome many of the difficult technical problems. For instance, another approach that has developed as a matter of expediency but proved quite practical, is to install an assembly operation in a transfer line. Snyder Tool and Engineering Co. has done some outstanding work with integration of assembly in transfer machines, for automotive parts particularly. An example is a 40-station, in-line transfer machine for chain case covers, which machines the cast-iron part, gages, air tests, marks and assembles the oil seals. The assembly operation comes at the third station in the eighth segment, and consists of pressing in the seals. These are stored in an unusual hopper shown in *Fig.* 9.

Seals are stacked in the vertical tubes mounted on a rotary table. A vertical chute mounted below the table, leads the oil seals to the loading mechanism. An index mechanism in the table aligns one of the vertical tubes with the chute. Two precision switches in the load chute are normally tripped by the seals. When one switch is released, it indicates that the chute requires refilling. The hopper then rotates to bring the next tube of seals into position over the load chute. When the second switch is actuated, it indicates that the load chute is running out of parts. This condition occurs when the hopper fails to rotate to the next position, that tube being empty. Then the loader and ejector cease to operate and a light labeled "Hopper Empty" goes on, telling the operator to refill the hopper.

When an oil seal falls in place under the press ram, there are four precision switches to assure positive positioning. Actuation of either of two switches indicates an upside-down seal and causes the seal to be ejected automatically. If both of the other two switches are actuated, a right-side-up seal condition is indicated and the part can be pressed in. If, however, only one of these latter two switches is operated, a cocked condition is indicated and the ejector removes the seal from the loader mechanism.

The press ram can come forward only when an oil seal is correctly positioned. With a seal properly seated, the ram presses it in to a proper depth as indicated by another switch. When the ram returns to starting position, the work-holding fixture

unclamps and the chain case cover and oil assembly are transferred to the next station where the part is unloaded.

A critical problem in pressing parts together involves size of the components. Both the hole into which the part is to be pressed, and the component must be gaged in process. Automatic ejection allowances for both parts must be built into the equipment. Otherwise, scrap and down time destroy the value of the operation.

Many of the basic principles involved in automatic assembly are similar in many respects to automation of machining. The rule that it is costly to lose control of a part once it has been grasped or held, is equally important in automatic assembly. In practice, one part generally can be chosen as the body for the starting point. The problem then becomes one of getting this under control and moving it from operation to operation.

For this purpose, fixtures, jigs, or nests are usually employed. Various types of transfer are used: circular indexing, in-line, closed track for return of holding fixtures, etc. Parts are added to the main body by riveting, staking, welding, press fit, cementing, gluing, screwing or bolting, soldering and brazing. Simple and symmetrical parts, such as typical fasteners can be fed by commercial feeders, gravity, vibratory, oscillating, and the like.

Storage of large parts especially poses a critical problem, because of the space involved as well as mass, when movement depends on an arm or other leverage in transfer. Nesting is also a problem in feeding parts, which frequently necessitates redesign of the part to permit separation and escapement singly. Feeding problems are particularly

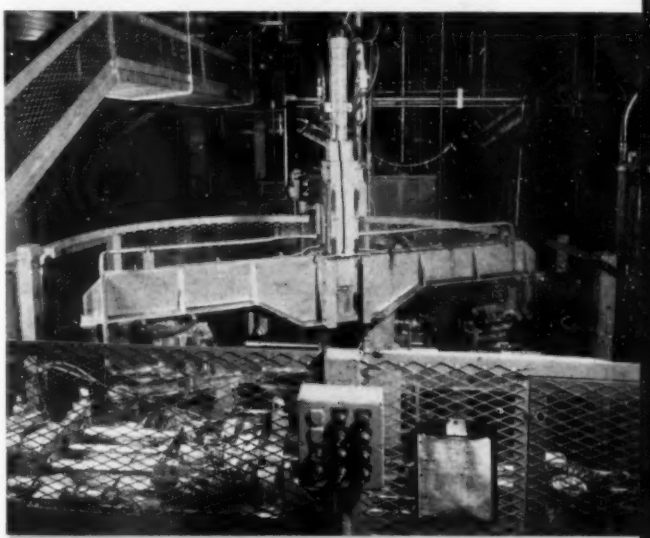
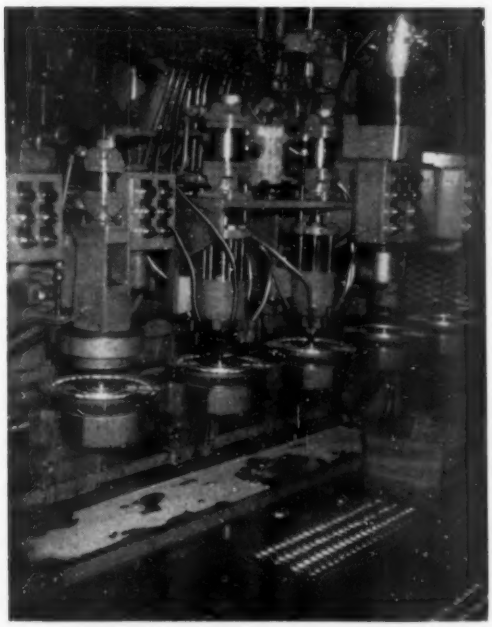
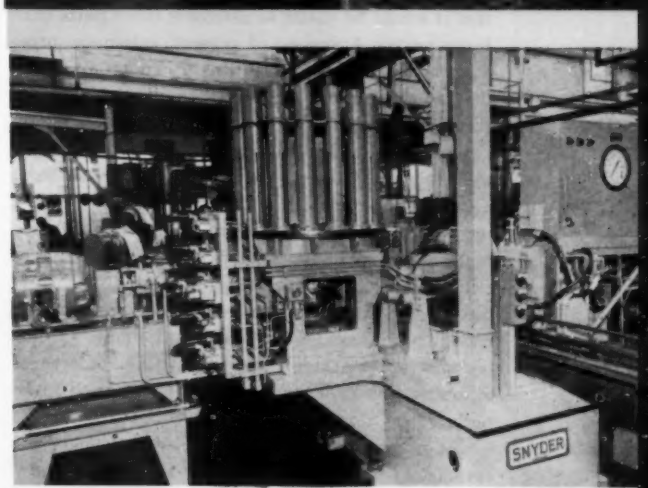


Fig. 7. (right) Transfer arm carries assembly and fixture from one track to another parallel to it.

Fig. 8. (below) Chip removal, rivet loading and probing stations of Detroit Transmission torus assembly machine.

Fig. 9 (bottom right) Typical of automatic assembly operations associated with machining automation is this Snyder transfer machine for production of chain case covers. It applies oil seals to the finished part at a rate of 108 per hour at 80 percent efficiency.





difficult for parts of indeterminate nature, such as lengths of wire, paper or cardboard, insulation, and the like, *Fig.* 10. Springs and other parts which may become badly intermeshed also create special problems in handling.

Tooling, holding devices, escapements, methods of orientating and indexing represent a considerable portion of the installation costs and are of prime concern to project engineers. Synchronization of operations with movement of parts between stations must be carefully controlled and precise.

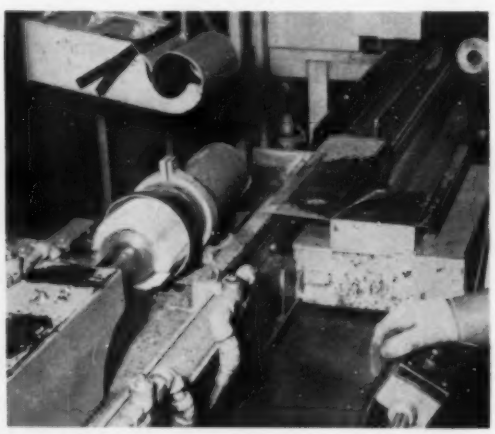


Fig. 10. Involuting operation spins paper filter element as it is inserted into case on production line at AC Spark Plug. To handle difficult parts such as these, manual operations are combined with automatic in the initial stages of production.

Often more elaborate controls are required than the usual relays and sequencing switches.

Because of these factors, it might be assumed that it would be easier to assemble small parts than large parts. A survey of present automatic processes bears this out. From this it can be concluded that at the present time small symmetrical parts, required in high volume which are or can be redesigned to fit together readily, are best suited for the process. If the parts can be dimensioned from a surface, hole, or other fixed reference point, that too will simplify the problem of development. In fact, as automatic assembly and other forms of automation assume increasing importance, a complete revision of dimensioning practices may be necessary. Tangible reference and tooling points become indispensable. Such geometrical references as center lines, corners and angles may need to be replaced by more practical ones.

The necessity for reliability is even stronger for automatic assembly, since usually there can be only one machine without the standby often provided for machining operations. For this reason, accessibility is usually the primary consideration rather than appearance. Controls should be maintained at eye level or near, if at all possible. It has been found, in many cases, possible to eliminate considerable control if the product is standard, with only one model required. Another desirable feature is simplicity, with mechanical linkage frequently preferred for this reason. It also gives positive action. Leakage may be a problem with hydraulic systems and air losses on pneumatic systems can prove costly. In addition, air is often undesirable because of noises produced in indexing.

Because of the complex nature of the operations, often the best approach is to introduce only a few mechanized assembly operations in a line with remaining hand operations paced to the machine. In this way, additional mechanization can be added as experience is gained and automaticity proves out. This approach frequently overcomes objections of management which is likely to become impatient with long tryout and adjustment periods required for a completely integrated automatic assembly installation.

With this type of approach it is quite probable that most plants producing products involving assembly can find some operations where manufacturing costs can be reduced by application of mechanized assembly. Even the low-volume producer usually has some subassembly or component which may be adaptable to automatic processing. To find these spots and then to devise the means of mechanizing them successfully poses a real challenge to the ingenuity and ability of tool engineers.

The technology is growing rapidly. Based on developments to date and those under way, it is safe to predict that progress in this important area of production will move much faster in the future and go much further than is apparent to date.

Acknowledgments

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General Riveters, Inc., ... Buffalo, N. Y.
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clearance fits

for holes and shafts

FIT is the general term used to signify the range of tightness which may result from the application of a specific combination of allowances and tolerances in the design of mating parts. The actual fit between two mating parts is the relation existing between them with respect to the amount of clearance or interference which is present when they are assembled.

Selection of the type of fit for cylindrical parts, such as mating holes and shafts, is determined by use or service requirements. Many factors, such as length of engagement, bearing load, speed, lubrication, temperature, humidity and materials, must be taken into consideration in the selection of fits for a particular application. Subsequent adjustments may be required when extreme conditions are encountered, to suit critical functional requirements or to permit maximum manufacturing economy.

Fits have been classified into five types. These are:

RC Running or sliding fits
LC Clearance locational fits
LT Transition fits
LN Locational interference fits
FN Force or shrink fits

Limits for the two types of clearance fits, running or sliding fits and clearance locational fits, are shown in TABLE 1 and TABLE 2. The letter symbols are used in conjunction with numbers representing the class of fit. Thus "RC 1" represents a class 1 running or sliding fit. Each such designation represents a complete fit, for which maximum and minimum clearance and limits of size for mating parts have been established. All limits have been established on a unilateral hole basis. These fits are represented graphically in *Figs.* 1 and 2.

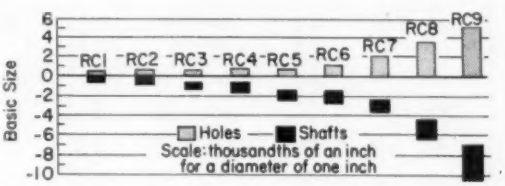

Fig. 1. Graphical representation of standard running or sliding fits.

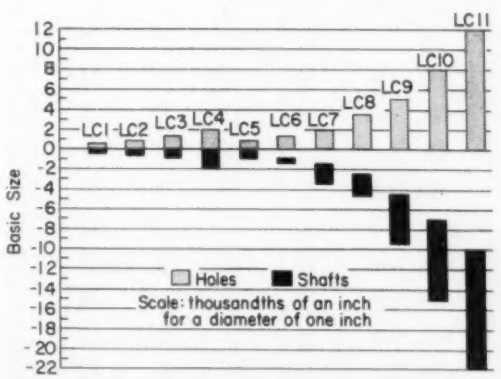

Fig. 2. Graphical representation of standard clearance locational fits.

Extracted from American Standard Preferred Limits and Fits for Cylindrical Parts (ASA B4.1-1955) with the permission of the publisher, The American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y.

Running or Sliding Fits: Classes of running or sliding fits are:

CLOSE SLIDING FITS, RC 1, are intended for the accurate location of parts which must assemble without perceptible play.

SLIDING FITS, RC 2, are specified for accurate location, but with greater maximum clearance than class RC 1. Parts made to this fit turn easily but are not intended to run freely and seizing may occur in the larger sizes as the result of small temperature changes.

PRECISION RUNNING FITS, RC 3, are the closest fits which can run freely, and are intended for precision work at slow speeds and light journal pressures. They are not suitable where appreciable temperature differences are likely to be encountered.

CLOSE RUNNING FITS, RC 4, are intended chiefly for running fits on accurate machinery with moderate surface speeds and journal pressures, where accurate location and minimum play are desired.

MEDIUM RUNNING FITS, RC 5 and RC 6, can be utilized for higher running speeds than possible with close running fits, for applications where heavy journal pressures are encountered, or both.

FREE RUNNING FITS, RC 7, can be used where accuracy is not essential, where large temperature variations are encountered, or for both conditions.

LOOSE RUNNING FITS, RC 8 and RC 9, are suitable where materials such as cold-rolled shafting and tubing, made to commercial tolerances, are involved.

The clearances for classes RC 1 and RC 2, used chiefly as sliding fits, increase more slowly with diameter than the other classes, so that accurate location is obtained even at the expense of free relative motion.

Clearance Locational Fits: For parts which are normally stationary, clearance locational fits can be used if free assembly or disassembly is desired. These fits run from snug fits for parts requiring accuracy of location, through medium clearance fits for parts such as spigots, to loose fastener fits where freedom of assembly is of prime importance.

Limits for other types of fits will be the subject of a future reference sheet.

Table 1—Running and Sliding Fits*

Nominal Size Range (Inches)		Class RC 1			Class RC 2			Class RC 3			Class RC 4		
		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits	
Over	To		Hole	Shaft		Hole	Shaft		Hole	Shaft		Hole	Shaft
0.04-	0.12	0.1 0.45	+0.2 0	— 0.1 — 0.25	0.1 0.55	+0.25 0	— 0.1 — 0.3	0.3 0.8	+0.25 0	— 0.3 — 0.55	0.3 1.1	+ 0.4 0	— 0.3 — 0.7
0.12-	0.24	0.15 0.5	+0.2 0	— 0.15 — 0.3	0.15 0.65	+0.3 0	— 0.15 — 0.35	0.4 1.0	+0.3 0	— 0.4 — 0.7	0.4 1.4	+ 0.5 0	— 0.4 — 0.9
0.24-	0.40	0.2 0.6	+0.25 0	— 0.2 — 0.35	0.2 0.85	+0.4 0	— 0.2 — 0.45	0.5 1.3	+0.4 0	— 0.5 — 0.9	0.4 1.7	+ 0.6 0	— 0.4 — 1.1
0.40-	0.71	0.25 0.75	+0.3 0	— 0.25 — 0.45	0.25 0.95	+0.4 0	— 0.25 — 0.55	0.6 1.4	+0.4 0	— 0.6 — 1.0	0.6 2.0	+ 0.7 0	— 0.6 — 1.3
0.71-	1.19	0.3 0.95	+0.4 0	— 0.3 — 0.55	0.3 1.2	+0.5 0	— 0.3 — 0.7	0.8 1.8	+0.5 0	— 0.8 — 1.3	0.8 2.4	+ 0.8 0	— 0.8 — 1.6
1.19-	1.97	0.4 1.1	+0.4 0	— 0.4 — 0.7	0.4 1.4	+0.6 0	— 0.4 — 0.8	1.0 2.2	+0.6 0	— 1.0 — 1.6	1.0 3.0	+ 1.0 0	— 1.0 — 2.0
1.97-	3.15	0.4 1.2	+0.5 0	— 0.4 — 0.7	0.4 1.6	+0.7 0	— 0.4 — 0.9	1.2 2.6	+0.7 0	— 1.2 — 1.9	1.2 3.6	+ 1.2 0	— 1.2 — 2.4
3.15-	4.73	0.5 1.5	+0.6 0	— 0.5 — 0.9	0.5 2.0	+0.9 0	— 0.5 — 1.1	1.4 3.2	+0.9 0	— 1.4 — 2.3	1.4 4.2	+ 1.4 0	— 1.4 — 2.8
4.73-	7.09	0.6 1.8	+0.7 0	— 0.6 — 1.1	0.6 2.3	+1.0 0	— 0.6 — 1.3	1.6 3.6	+1.0 0	— 1.6 — 2.6	1.6 4.8	+ 1.6 0	— 1.6 — 3.2
7.09-	9.85	0.6 2.0	+0.8 0	— 0.6 — 1.2	0.6 2.6	+1.2 0	— 0.6 — 1.4	2.0 4.4	+1.2 0	— 2.0 — 3.2	2.0 5.6	+ 1.8 0	— 2.0 — 3.8
9.85-	12.41	0.8 2.3	+0.9 0	— 0.8 — 1.4	0.8 2.9	+1.2 0	— 0.8 — 1.7	2.5 4.9	+1.2 0	— 2.5 — 3.7	2.5 6.5	+ 2.0 0	— 2.5 — 4.5
12.41-	15.75	1.0 2.7	+1.0 0	— 1.0 — 1.7	1.0 3.4	+1.4 0	— 1.0 — 2.0	3.0 5.8	+1.4 0	— 3.0 — 4.4	3.0 7.4	+ 2.2 0	— 3.0 — 5.2
15.75-	19.69	1.2 3.0	+1.0 0	— 1.2 — 2.0	1.2 3.8	+1.6 0	— 1.2 — 2.2	4.0 7.2	+1.6 0	— 4.0 — 5.6	4.0 9.0	+ 2.5 0	— 4.0 — 6.5
19.69-	30.09	1.6 3.7	+1.2 0	— 1.6 — 2.5	1.6 4.8	+2.0 0	— 1.6 — 2.8	5.0 9.0	+2.0 0	— 5.0 — 7.0	5.0 11.0	+ 3.0 0	— 5.0 — 8.0
30.09-	41.49	2.0 4.6	+1.6 0	— 2.0 — 3.0	2.0 6.1	+2.5 0	— 2.0 — 3.6	6.0 11.0	+2.5 0	— 6.0 — 8.5	6.0 14.0	+ 4.0 0	— 6.0 —10.0
41.49-	56.19	2.5 5.7	+2.0 0	— 2.5 — 3.7	2.5 7.5	+3.0 0	— 2.5 — 4.5	8.0 14.0	+3.0 0	— 8.0 —11.0	8.0 18.0	+ 5.0 0	— 8.0 —13.0

*All limits are in thousandths of an inch. Limits for hole and shaft are applied algebraically to the basic size to obtain the limits of size for the parts.

Table 1—Running and Sliding Fits* *(continued)*

Nominal Size Range (Inches)		Class RC 5			Class RC 6			Class RC 7			Class RC 8			Class RC 9		
		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits	
Over	To		Hole	Shaft		Hole	Shaft		Hole	Shaft		Hole	Shaft		Hole	Shaft
0.04-	0.12	0.6 1.4	+ 0.4 0	− 0.6 − 1.0	0.6 1.8	+ 0.6 0	− 0.6 − 1.2	1.0 2.6	+ 1.0 0	− 1.0 − 1.6	2.5 5.1	+ 1.6 0	− 2.5 − 3.5	4.0 8.1	+ 2.5 0	− 4.0 − 5.6
0.12-	0.24	0.8 1.8	+ 0.5 0	− 0.8 − 1.3	0.8 2.2	+ 0.7 0	− 0.8 − 1.5	1.2 3.1	+ 1.2 0	− 1.2 − 1.9	2.8 5.8	+ 1.8 0	− 2.8 − 4.0	4.5 9.3	+ 3.0 0	− 4.5 − 6.0
0.24-	0.40	1.0 2.2	+ 0.6 0	− 1.0 − 1.6	1.0 2.8	+ 0.9 0	− 1.0 − 1.9	1.6 3.9	+ 1.4 0	− 1.6 − 2.5	3.0 6.6	+ 2.2 0	− 3.0 − 4.4	5.0 10.7	+ 3.5 0	− 5.0 − 7.2
0.40-	0.71	1.2 2.6	+ 0.7 0	− 1.2 − 1.9	1.2 3.2	+ 1.0 0	− 1.2 − 2.2	2.0 4.6	+ 1.6 0	− 2.0 − 3.0	3.5 7.9	+ 2.8 0	− 3.5 − 5.1	6.0 12.8	+ 4.0 0	− 6.0 − 8.8
0.71-	1.19	1.6 3.2	+ 0.8 0	− 1.6 − 2.4	1.6 4.0	+ 1.2 0	− 1.6 − 2.8	2.5 5.7	+ 2.0 0	− 2.5 − 3.7	4.5 10.0	+ 3.5 0	− 4.5 − 6.5	7.0 15.5	+ 5.0 0	− 7.0 − 10.5
1.19-	1.97	2.0 4.0	+ 1.0 0	− 2.0 − 3.0	2.0 5.2	+ 1.6 0	− 2.0 − 3.6	3.0 7.1	+ 2.5 0	− 3.0 − 4.6	5.0 11.5	+ 4.0 0	− 5.0 − 7.5	8.0 18.0	+ 6.0 0	− 8.0 − 12.0
1.97-	3.15	2.5 4.9	+ 1.2 0	− 2.5 − 3.7	2.5 6.1	+ 1.8 0	− 2.5 − 4.3	4.0 8.8	+ 3.0 0	− 4.0 − 5.8	6.0 13.5	+ 4.5 0	− 6.0 − 9.0	9.0 20.5	+ 7.0 0	− 9.0 − 13.5
3.15-	4.73	3.0 5.8	+ 1.4 0	− 3.0 − 4.4	3.0 7.4	+ 2.2 0	− 3.0 − 5.2	5.0 10.7	+ 3.5 0	− 5.0 − 7.2	7.0 15.5	+ 5.0 0	− 7.0 − 10.5	10.0 24.0	+ 9.0 0	− 10.0 − 15.0
4.73-	7.09	3.5 6.7	+ 1.6 0	− 3.5 − 5.1	3.5 8.5	+ 2.5 0	− 3.5 − 6.0	6.0 12.5	+ 4.0 0	− 6.0 − 8.5	8.0 18.0	+ 6.0 0	− 8.0 − 12.0	12.0 28.0	+ 10.0 0	− 12.0 − 18.0
7.09-	9.85	4.0 7.6	+ 1.8 0	− 4.0 − 5.8	4.0 9.6	+ 2.8 0	− 4.0 − 6.8	7.0 14.3	+ 4.5 0	− 7.0 − 9.8	10.0 21.5	+ 7.0 0	− 10.0 − 14.5	15.0 34.0	+ 12.0 0	− 15.0 − 22.0
9.85-	12.41	5.0 9.0	+ 2.0 0	− 5.0 − 7.0	5.0 11.0	+ 3.0 0	− 5.0 − 8.0	8.0 16.0	+ 5.0 0	− 8.0 − 11.0	12.0 25.0	+ 8.0 0	− 12.0 − 17.0	18.0 38.0	+ 12.0 0	− 18.0 − 26.0
12.41-	15.75	6.0 10.4	+ 2.2 0	− 6.0 − 8.2	6.0 13.0	+ 3.5 0	− 6.0 − 9.5	10.0 19.5	+ 6.0 0	− 10.0 − 13.5	14.0 29.0	+ 9.0 0	− 14.0 − 20.0	22.0 45.0	+ 14.0 0	− 22.0 − 31.0
15.75-	19.69	8.0 13.0	+ 2.5 0	− 8.0 −10.5	8.0 16.0	+ 4.0 0	− 8.0 −12.0	12.0 22.0	+ 6.0 0	− 12.0 − 16.0	16.0 32.0	+10.0 0	− 16.0 − 22.0	25.0 51.0	+ 16.0 0	− 25.0 − 35.0
19.69-	30.09	10.0 16.0	+ 3.0 0	−10.0 −13.0	10.0 20.0	+ 5.0 0	−10.0 −15.0	16.0 29.0	+ 8.0 0	− 16.0 − 21.0	20.0 40.0	+12.0 0	− 20.0 − 28.0	30.0 62.0	+ 20.0 0	− 30.0 − 42.0
30.09-	41.49	12.0 20.0	+ 4.0 0	−12.0 −16.0	12.0 24.0	+ 6.0 0	−12.0 −18.0	20.0 36.0	+10.0 0	− 20.0 − 26.0	25.0 51.0	+16.0 0	− 25.0 − 35.0	40.0 81.0	+ 25.0 0	− 40.0 − 56.0
41.49	56.19	16.0 26.0	+ 5.0 0	−16.0 −21.0	16.0 32.0	+ 8.0 0	−16.0 −24.0	25.0 45.0	+12.0 0	− 25.0 − 33.0	30.0 62.0	+20.0 0	− 30.0 − 42.0	50.0 100	+ 30.0 0	− 50.0 − 70.0

Table 2—Clearance Locational Fits*

Nominal Size Range (Inches)		Class LC 1			Class LC 2			Class LC 3			Class LC 4			Class LC 5		
		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits	
Over	To		Hole	Shaft		Hole	Shaft		Hole	Shaft		Hole	Shaft		Hole	Shaft
0.04—	0.12	0 0.45	+ 0.25 − 0	+ 0 −0.2	0 0.65	+ 0.4 − 0	+ 0 − 0.25	0 1	+ 0.6 − 0	+ 0 − 0.4	0 2.0	+ 1.0 − 0	+ .0 − 1.0	0.1 0.75	+ 0.4 − 0	− 0.1 − 0.35
0.12—	0.24	0 0.5	+ 0.3 − 0	+ 0 −0.2	0 0.8	+ 0.5 − 0	+ 0 − 0.3	0 1.2	+ 0.7 − 0	+ 0 − 0.5	0 2.4	+ 1.2 − 0	+ 0 − 1.2	0.15 0.95	+ 0.5 − 0	− 0.15 − 0.45
0.24—	0.40	0 0.65	+ 0.4 − 0	+ 0 −0.25	0 1.0	+ 0.6 − 0	+ 0 − 0.4	0 1.5	+ 0.9 − 0	+ 0 − 0.6	0 2.8	+ 1.4 − 0	+ 0 − 1.4	0.2 1.2	+ 0.6 − 0	− 0.2 − 0.6
0.40—	0.71	0 0.7	+ 0.4 − 0	+ 0 −0.3	0 1.1	+ 0.7 − 0	+ 0 − 0.4	0 1.7	+ 1.0 − 0	+ 0 − 0.7	0 3.2	+ 1.6 − 0	+ 0 − 1.6	0.25 1.35	+ 0.7 − 0	− 0.25 − 0.65
0.71—	1.19	0 0.9	+ 0.5 − 0	− 0 −0.4	0 1.3	+ 0.8 − 0	+ 0 − 0.5	0 2	+ 1.2 − 0	+ 0 − 0.8	0 4	+ 2.0 − 0	+ 0 − 2.0	0.3 1.6	+ 0.8 − 0	− 0.3 − 0.8
1.19—	1.97	0 1.0	+ 0.6 − 0	+ 0 −0.4	0 1.6	+ 1.0 − 0	+ 0 − 0.6	0 2.6	+ 1.6 − 0	+ 0 − 1	0 5	+ 2.5 − 0	+ 0 − 2.5	0.4 2.0	+ 1.0 − 0	− 0.4 − 1.0
1.97—	3.15	0 1.2	+ 0.7 − 0	+ 0 −0.5	0 1.9	+ 1.2 − 0	+ 0 − 0.7	0 3	+ 1.8 − 0	+ 0 − 1.2	0 6	+ 3 − 0	+ 0 − 3	0.4 2.3	+ 1.2 − 0	− 0.4 − 1.1
3.15—	4.73	0 1.5	+ 0.9 − 0	+ 0 −0.6	0 2.3	+ 1.4 − 0	+ 0 − 0.9	0 3.6	+ 2.2 − 0	+ 0 − 1.4	0 7	+ 3.5 − 0	+ 0 − 3.5	0.5 2.8	+ 1.4 − 0	− 0.5 − 1.4
4.73—	7.09	0 1.7	+ 1.0 − 0	+ 0 −0.7	0 2.6	+ 1.6 − 0	+ 0 − 1.0	0 4.1	+ 2.5 − 0	+ 0 − 1.6	0 8	+ 4 − 0	+ 0 − 4	0.6 3.2	+ 1.6 − 0	− 0.6 − 1.6
7.09—	9.85	0 2.0	+ 1.2 − 0	+ 0 −0.8	0 3.0	+ 1.8 − 0	+ 0 − 1.2	0 4.6	+ 2.8 − 0	+ 0 − 1.8	0 9	+ 4.5 − 0	+ 0 − 4.5	0.6 3.6	+ 1.8 − 0	− 0.6 − 1.8
9.85—	12.41	0 2.1	+ 1.2 − 0	+ 0 −0.9	0 3.2	+ 2.0 − 0	+ 0 − 1.2	0 5	+ 3.0 − 0	+ 0 − 2.0	0 10	+ 5 − 0	+ 0 − 5	0.7 3.9	+ 2.0 − 0	− 0.7 − 1.9
12.41—	15.75	0 2.4	+ 1.4 − 0	+ 0 −1.0	0 3.6	+ 2.2 − 0	+ 0 − 1.4	0 5.7	+ 3.5 − 0	+ 0 − 2.2	0 12	+ 6 − 0	+ 0 − 6	0.7 4.3	+ 2.2 − 0	− 0.7 − 2.1
15.75—	19.69	0 2.6	+ 1.6 − 0	+ 0 −1.0	0 4.1	+ 2.5 − 0	+ 0 − 1.6	0 6.5	+ 4 − 0	+ 0 − 2.5	0 12	+ 6 − 0	+ 0 − 6	0.8 4.9	+ 2.5 − 0	− 0.8 − 2.4
19.69—	30.09	0 3.2	+ 2.0 − 0	+ 0 −1.2	0 5.0	+ 3 − 0	+ 0 − 2	0 8	+ 5 − 0	+ 0 − 3	0 16	+ 8 − 0	+ 0 − 8	0.9 5.9	+ 3.0 − 0	− 0.9 − 2.9
30.09—	41.49	0 4.1	+ 2.5 − 0	+ 0 −1.6	0 6.5	+ 4 − 0	+ 0 − 2.5	0 10	+ 6 − 0	+ 0 − 4	0 20	+10 − 0	+ 0 −10	1.0 7.5	+ 4.0 − 0	− 1.0 − 3.5
41.49—	56.19	0 5.0	+ 3.0 − 0	+ 0 −2.0	0 8.0	+ 5 − 0	+ 0 − 3	0 13	+ 8 − 0	+ 0 − 5	0 24	+12 − 0	+ 0 −12	1.2 9.2	+ 5.0 − 0	− 1.2 − 4.2

*All limits are in thousandths of an inch. Limits for hole and shaft are applied algebraically to the basic size to obtain the limits of size for the parts.

Table 2—Clearance Locational Fits* *(continued)*

Nominal Size Range (Inches)		Class LC 6			Class LC 7			Class LC 8			Class LC 9			Class LC 10			Class LC 11		
		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits	
Over	To		Hole	Shaft		Hole	Shaft		Hole	Shaft		Hole	Shaft		Hole	Shaft		Hole	Shaft
0.04-	0.12	0.3 1.5	+ 0.6 — 0	— 0.3 — 0.9	0.6 2.6	+ 1.0 — 0	— 0.6 — 1.6	1.0 2.0	+ 1.6 — 0	— 1.0 — 2.0	2.5 7.5	+ 2.5 — 0	— 2.5 — 5.0	4 12	+ 4 — 0	— 4 — 8	5 17	+ 6 — 0	— 5 — 11
0.12-	0.24	0.4 1.8	+ 0.7 — 0	— 0.4 — 1.1	0.8 3.2	+ 1.2 — 0	— 0.8 — 2.0	1.2 4.2	+ 1.8 — 0	— 1.2 — 2.4	2.8 8.8	+ 3.0 — 0	— 2.8 — 5.8	4.5 14.5	+ 5 — 0	— 4.5 — 9.5	6 20	+ 7 — 0	— 6 — 13
0.24-	0.40	0.5 2.3	+ 0.9 — 0	— 0.5 — 1.4	1.0 3.8	+ 1.4 — 0	— 1.0 — 2.4	1.6 5.2	+ 2.2 — 0	— 1.6 — 3.0	3.0 10.0	+ 3.5 — 0	— 3.0 — 6.5	5 17	+ 6 — 0	— 5 — 11	7 25	+ 9 — 0	— 7 — 16
0.40-	0.71	0.6 2.6	+ 1.0 — 0	— 0.6 — 1.6	1.2 4.4	+ 1.6 — 0	— 1.2 — 2.8	2.0 6.4	+ 2.8 — 0	— 2.0 — 3.6	3.5 11.5	+ 4.0 — 0	— 3.5 — 7.5	6 20	+ 7 — 0	— 6 — 13	8 28	+ 10 — 0	— 8 — 18
0.71-	1.19	0.8 3.2	+ 1.2 — 0	— 0.8 — 2.0	1.6 5.6	+ 2.0 — 0	— 1.6 — 3.6	2.5 8.0	+ 3.5 — 0	— 2.5 — 4.5	4.5 14.5	+ 5.0 — 0	— 4.5 — 9.5	7 23	+ 8 — 0	— 7 — 15	10 34	+ 12 — 0	— 10 — 22
1.19-	1.97	1.0 4.2	+ 1.6 — 0	— 1.0 — 2.6	2.0 7.0	+ 2.5 — 0	— 2.0 — 4.5	3.6 9.5	+ 4.0 — 0	— 3.0 — 5.5	5 17	+ 6 — 0	— 5 —11	8 28	+ 10 — 0	— 8 — 18	12 44	+ 16 — 0	— 12 — 28
1.97-	3.15	1.2 4.8	+ 1.8 — 0	— 1.0 — 3.0	2.5 8.5	+ 3.0 — 0	— 2.5 — 5.5	4.0 11.5	+ 4.5 — 0	— 4.0 — 7.0	6 20	+ 7 — 0	— 6 —13	10 34	+ 12 — 0	— 10 — 22	14 50	+ 18 — 0	— 14 — 32
3.15-	4.73	1.4 5.8	+ 2.2 — 0	— 1.4 — 3.6	3.0 10.0	+ 3.5 — 0	— 3.0 — 6.5	5.0 13.5	+ 5.0 — 0	— 5.0 — 8.5	7 25	+ 9 — 0	— 7 —16	11 39	+ 14 — 0	— 11 — 25	16 60	+ 22 — 0	— 16 — 38
4.73-	7.09	1.6 6.6	+ 2.5 — 0	— 1.6 — 4.1	3.5 11.5	+ 4.0 — 0	— 3.5 — 7.5	6 16	+ 6 — 0	— 6 —10	8 28	+10 — 0	— 8 —18	12 44	+ 16 — 0	— 12 — 28	18 68	+ 25 — 0	— 18 — 43
7.09-	9.85	2.0 7.6	+ 2.8 — 0	— 2.0 — 4.8	4.0 13.0	+ 4.5 — 0	— 4.0 — 8.5	7 18.5	+ 7 — 0	— 7 —11.5	10 34	+12 — 0	—10 —22	16 52	+ 18 — 0	— 16 — 34	22 78	+ 28 — 0	— 22 — 50
9.85-	12.41	2.2 8.2	+ 3.0 — 0	— 2.2 — 5.2	4.5 14.5	+ 5.0 — 0	— 4.5 — 9.5	7 20	+ 8 — 0	— 7 —12	12 36	+12 — 0	—12 —24	20 60	+ 20 — 0	— 20 — 40	28 88	+ 30 — 0	— 28 — 58
12.41-	15.75	2.5 9.5	+ 3.5 — 0	— 2.5 — 6.0	5 17	+ 6 — 0	— 5 —11	8 23	+ 9 — 0	— 8 —14	14 42	+14 — 0	—14 —28	22 66	+ 22 — 0	— 22 — 44	30 100	+ 35 — 0	— 30 — 65
15.75-	19.69	2.8 10.8	+ 4.0 — 0	— 2.8 — 6.8	5 17	+ 6 — 0	— 5 —11	9 25	+10 — 0	— 9 —15	16 48	+16 — 0	—16 —32	25 75	+ 25 — 0	— 25 — 50	35 115	+ 40 — 0	— 35 — 75
19.69-	30.09	3.0 13.0	+ 5.0 — 0	— 3.0 — 8.0	6 22	+ 8 — 0	— 6 —14	10 20	+12 — 0	—10 —18	18 58	+20 — 0	—18 —38	28 88	+ 30 — 0	— 28 — 58	40 140	+ 50 — 0	— 40 — 90
30.09-	41.49	3.5 15.5	+ 6.0 — 0	— 3.5 — 9.5	7 27	+10 — 0	— 7 —17	12 38	+16 — 0	—12 —22	20 70	+25 — 0	—20 —45	30 110	+ 40 — 0	— 30 — 70	45 165	+ 60 — 0	— 45 —105
41.49-	56.19	4.0 20.0	+ 8.0 — 0	— 4.0 —12.0	8 32	+12 — 0	— 8 —20	14 46	+20 — 0	—14 —26	25 85	+30 — 0	—25 —55	40 140	+ 50 — 0	— 40 — 90	60 220	+ 80 — 0	— 60 —140

*All limits are in thousandths of an inch. Limits for hole and shaft are applied algebraically to the basic size to obtain the limits of size for the parts.

Glossary of Terms

Allowance. An allowance is an intentional difference between the maximum material limits of mating parts. It is a minimum clearance (positive allowance) or maximum interference (negative allowance) between mating parts.

Tolerance. A tolerance is the total permissible variation of a size.

Tolerance Limit. A tolerance limit is the variation, positive or negative, by which a size is permitted to depart from the design size.

Unilateral Tolerance. A unilateral tolerance is a tolerance in which variation is permitted only in one direction from the design size.

Bilateral Tolerance. A bilateral tolerance is a tolerance in which variation is permitted in both directions from the design size.

Fit. Fit is the general term used to signify the range of tightness which may result from the application of a specific combination of allowances and tolerances in the design of mating parts.

Actual Fit. The actual fit between two mating parts is the relation existing between them with respect to the amount of clearance or interference which is present when they are assembled. The actual size of a part is its measured size.

Basic Hole System. A basic hole system is a system of fits in which the design size of the hole is the basic size and the allowance is applied to the shaft.

Basic Shaft System. A basic shaft system is a system of fits in which the design size of the shaft is the basic size and the allowance is applied to the hole.

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12 month plan

ASTE Chapters Reach Mid-Point of Year Long Plan

A year-long program, the Twelve-Month Plan, to familiarize industry and educators with ASTE through its local chapters, has now reached the half-way mark.

Over the past six months the Plan has proven highly successful, and the 110 chapters participating at this time are preparing to embark enthusiastically on the remainder of the program with other chapters added to their ranks.

Its over-all objectives are to inform industrial management and educators about: what tool engineering is, the importance of tool engineering, and the activities and objectives of ASTE.

Developed from suggestions offered by national delegates and many other members, the program includes their recommendations for securing greater interest, understanding and prestige for the Society and the tool engineering profession. Each suggestion was weighed carefully for its benefit to members and to the Society as a whole.

To direct the undertaking, President McMillen appointed five men to be known as the Delegates' Twelve-Month Plan Committee. Their task was to promote the proposal actively in their own chapters and, even more important, to work toward assuring its success on a national basis.

Serving as chairman is Carl S. Abbott of Detroit chapter, ably assisted by Glen Dilling of St. Louis, C. Jenness Cameron of Twin States, Lawrence D. Pomerantz of Long Beach, and Donald Nesbit of Windsor.

The first six months' activity has already resulted in nearly 3,000 personal contacts with top industrial management and educators in the engineering field by the 110 chapters.

To start off the project last April, the chapters compiled lists of educational institutions in their areas, and two or three schools were assigned to each member of the chapter executive committee. Committee members then visited the schools and colleges to learn the names and titles of key individuals through whom they could work.

Subsequently, industrial management men were contacted in the same way and told about ASTE, after which they received the folder, "ASTE and Industry," and a brochure entitled, "A Career For You in Tool Engineering."

During July and August ASTE Headquarters sent a copy of THE TOOL ENGINEER and "The First Tool Engineer" to each of these industrialists and educators. They also received other brochures and mailing pieces about ASTE and tool engineering from the chapter members who had made the original contacts.

In addition, a 20-minute sound-slide film has recently been made available to chapters. This film, covering all aspects of the plan's operation, clarifies its objectives and month-to-month activities.

Industry and Education Night

At present, plans are being made for an "Industry and Education Night," which will be held by each chapter in November. At this event, which will be the high point of the program, educators, tool engineers and industry leaders will be invited to

12 month plan

speak, as well as members of state professional engineering registration boards.

Several chapters from the same areas are planning to integrate their programs for this event while others will use different approaches. For example, the Chicago chapter has arranged to hold its "Industry and Education Night" at Illinois Institute of Technology, in cooperation with the institute. Among the speakers at this on-campus meeting will be Dr. John T. Rettaliata, president of the institute; ASTE President Howard C. McMillen; and Dr. Harry B. Osborn, Jr., immediate past president.

Following up this event a booklet, "ASTE and You," and a copy of the Society's Annual Report will go to each industrialist and educator in December. The chapter membership committee in January will discuss possible new Society members from among those industrialists and educators contacted during the year.

Rounding out the program, a folder on the ASTE Research Fund will be distributed in February outlining the many types of research ASTE is carrying on at its own expense.

At the project's conclusion in March, 1957, each new national delegate will report the results of his chapter's efforts at the 1957 House of Delegates Conference in Houston, Texas.

What is Tool Engineering?

In carrying out the Twelve-Month Plan, members have been asked such questions as:

"What is tool engineering?"

"How does tool engineering differ from mechanical engineering?"

Many questions were also posed concerning ASTE:

"Why does ASTE exist?"

"What does ASTE offer industry and the tool engineer?"

"What is ASTE doing in research, education and standards work?"

The Twelve-Month Plan provides answers to such questions, as well as much additional information about the profession and the Society.

What is ASTE Doing?

By means of this program, ASTE is acquainting management and educators with the fact that ASTE is a technical society of 35,000 members, publishing its own *Tool Engineers Handbook*, *Die Design Handbook*, its own monthly technical magazine, THE TOOL ENGINEER, and is carrying on an extensive research program in tool engineering, supporting scholarships, awarding medals for national achievement, and instigating many other activities. All of this adds up to producing better tool engineers and improving America's standard of living.

During the present shortage of technicians, engineers and scientists, ASTE is doing its utmost to relieve this situation through the plan outlined.

Contact with educators is important to ASTE because they have the opportunity to guide and counsel young men who are interested in engineering. Present college curricula can be improved if we tell our educators just what tool engineering is, why industry so desperately needs formally trained tool engineers, and the function of ASTE in aiding educators, engineers and industry.

For many chapters the Twelve-Month Plan is merely a continuation of their own self-instigated efforts, for they are already in close touch with top industrialists and engineering educators in their areas. The plan offers these chapters new ideas and well-organized facts to serve as a springboard each month for far-reaching action.

Cleveland is among those chapters which, even before the Plan was inaugurated, have been carrying out their own program to create wider awareness of ASTE and the profession of tool engineering. It is printing a booklet, "Can I Be A Tool Engineer?" as a sequel to a primer already distributed throughout local schools. Members have been giving speeches, answering questions, and cooperating with the board of education as well as the city's teaching staff. In addition, the chapter has allotted a $500 scholarship yearly for a worthy student to go toward his senior year college tuition.

Other chapters are developing their own variations. For instance, Keystone is coordinating certain phases of the Twelve-Month Plan with a Scranton Chamber of Commerce project, in conjunction with local firms, to promote a technical school to supply local industries with trained personnel.

Variations on the Plan

Another chapter elaborating on the same basic outline is Paterson, which has always maintained a liaison with educators. It has devoted a meeting night to a campaign for recruiting instructors for the Industries Training School at Stevens Institute of Technology, offering certificate courses in tool design, machine design, electronics and production management. The group keeps in close contact with Paterson Technical and Vocational High School, and invites faculty and students to its monthly meetings. Plans are under way to devote a meeting to tool engineering education, and to grant awards to students in the field of tool engineering.

Muskegon reports that it has established a $500 fund for education work with local schools.

On the West Coast, Portland has already added professors to its membership roster and scheduled visits to the Engineering School of Oregon State University.

As the first half of the campaign draws to an end, each chapter is continuing to combine its own ideas with the original program to take full advantage of its potentialities, and now looks forward to carrying out the month-by-month schedule through the second half of the year.

The Twelve-Month Plan is already assured of success, and with the continuing cooperation of all chapters in the United States and Canada, the recognition and prestige of ASTE in industrial and educational circles will constantly increase.

GADGETS *contest!*

Every practicing tool engineer has ideas for relatively simple and low-cost devices or methods that make toolroom or production jobs easier, safer, or more efficient.

If you have worked out a clever solution to a tool engineering problem, or know of one in your shop, you can win cash prizes by entering the Gadgets Contest. At the same time, you'll be benefiting other tool engineers who may find that your gadget is just what they've been looking for to solve a specific problem.

The contest starts September 1, 1956, and will run until midnight on December 31, 1956. Prizes are: first prize, $100; two second prizes of $50 each; four third prizes of $25; plus copies of the *Tool Engineers Handbook* or *Die Design Handbook* which will be awarded to the authors of the next best entries.

So why wait? Read the contest rules below, then write up that pet gadget. You may win a prize and, if your entry is printed in THE TOOL ENGINEER, you'll receive the usual honorarium in addition to being eligible for one of the many prizes.

Some typical gadgets are printed in the technical section of this issue. Chances are you have a better one, which would be of interest to other tool engineers. If so, the Gadgets Contest is for you. Send your entry as soon as possible.

Gadgets Contest Rules

1. ELIGIBILITY: This contest is open to all members of the American Society of Tool Engineers.
2. DEFINITION: "Gadgets" are defined as tools or methods developed to solve specific production problems. They should contain a useful and practical idea or indicate an ingenious solution to a tool engineering problem.
3. PRIZES: One $100 first prize, two $50 second prizes, four $25 third prizes, and honorable mention awards consisting of copies of the *Tool Engineers Handbook* or *Die Design Handbook* published by the American Society of Tool Engineers. Certificates will be awarded to all prize winners.
4. PERIOD: The contest will run until December 31, 1956. All contributions to the Gadgets Department received from ASTE members during the period of the contest will be considered as entries.
5. JUDGING: Entries will be judged on the basis of originality, conciseness and completeness of presentation, and usefulness to other tool engineers. Members of the ASTE National Editorial Committee will serve as judges. Winners will be notified by mail as soon as possible after completion of judging. A list of winning entries will be published in THE TOOL ENGINEER.
6. ENTRIES: The name and chapter affiliation of the author should be written on each page of the entry. No entries will be returned. All publication rights are assigned to THE TOOL ENGINEER. Authors of entries published in THE TOOL ENGINEER will receive honorariums. Information which has been published previously is not eligible.
7. LENGTH: Entries should be limited to 500 words or less. Sketches or photographs should be used to illustrate the methods or devices described in the text of the entry.
8. MAIL ENTRIES TO: Gadgets Contest Editor, THE TOOL ENGINEER, 10700 Puritan Ave., Detroit 38, Mich.

ASTE INCOME PROTECTION PLAN

Who? What? Why? When? How?

What do I do to enroll in the Plan?

Just fill out the application blank, attach your check for the proper premium, and mail to ASTE Group Insurance Administration, 2210 Park Avenue, 10th Floor, Detroit 1, Michigan. If you do not have an application blank, or wish additional information, write to the same address.

Does the Plan cover only sicknesses that originate after the effective date?

No. It covers all disabilities regardless of date of origin of sickness provided the member is not disabled on the effective date of his insurance. Thus, pre-existing conditions are covered.

Does the Plan provide a "grace period" for paying premiums?

Yes, there is a 31-day grace period for payment of premiums. For example, if the premium is due on October 1, you would have until November 1 to pay it.

What if I am disabled for a long period? Would I still have to pay the premiums?

No, the Plan provides for waiving the premium, but continuing your coverage, after you have been continuously disabled for six months.

Can the company ever refuse to renew my insurance?

No. Coverage of the individual ASTE member cannot be terminated or restricted by the company as long as the Plan remains in force—until you retire or reach age 70. Membership in ASTE is mandatory, however.

I am a teacher and ASTE member. If I take a summer job doing some other kind of work, will this prevent me from being eligible?

No, this does not violate the qualification of being "a member of ASTE currently on active duty."

At the moment I am between jobs but expect to be employed shortly with another engineering firm. Am I eligible?

Yes, you are still on active duty and not retiring or physically unable to work.

Who is underwriting the Plan?

Continental Casualty Company of Chicago.

How is the Plan administered and how do I report a claim?

Claims, policyholders' service and premium collections are all handled through ASTE Group Insurance Administration, 2210 Park Avenue, 10th Floor, Detroit 1, Michigan. They will furnish claim forms to be completed by you and your attending physician. Upon return to the administrators, your claim will receive instant attention, and claims will be paid promptly throughout the period of disability, as provided.

Will benefits be pro-rated or reduced if I have other insurance?

No, full benefits are payable regardless of any other insurance or other source of indemnity or income.

When do benefits begin?

Weekly accident indemnity is payable from the first day or 91st day of total disability, depending on the plan selected. Weekly sickness indemnity is payable from the first day of hospitalization or eighth day of disability, whichever occurs first; or the 91st day of illness, depending on the plan selected.

How long will benefits be paid?

Weekly accident indemnity is payable up to 10 years (520 weeks). Weekly sickness indemnity is payable up to two years (104 weeks).

Do I have to be confined to the house in order to receive benefits?

No, full benefits are payable whether you are confined to the house or not.

Is there any accidental death benefit?

Yes. The full principal sum is paid to the beneficiary when injury results in death within one year from the date of the accident.

Are special benefits paid for dismemberment?

Yes. The principal sum as scheduled is paid for loss of limb, sight or hearing.

Are these "principal sum" benefits paid in addition to the weekly disability?

Yes. They never operate as a limitation of the disability indemnity.

Charter Given to Mansfield Chapter

President Howard C. McMillen presents the society's charter to Ward Ingraham, chairman of the newly formed Mansfield chapter, as David Cole, first vice chairman, watches.

One hundred members of the newly chartered Mansfield chapter, forming the 13th ASTE chapter in Ohio, were present at the June 21 chartering ceremonies.

Officers of the newly formed chapter are Ward Ingraham, of Westinghouse Corp., chairman; David Cole, Cole Tool and Die Co., first vice chairman; William Burrer, Empire Steel Corp., second vice chairman; Mel Brooking, F. E. Myers and Bros. Co., secretary; Don Smith, F. E. Myers and Bros. Co., treasurer; Ferd Loykovich, Westinghouse Corp., national delegate.

ASTE national officers present were: Howard C. McMillen, president ASTE; Marvin Bunting, staff administrator, headquarters; William Moreland, secretary; Frank Flannery, Membership Committee; and Ray Peterson, director.

At the chapter's first official meeting, Mr. E. J. Hegarty of Westinghouse Corp. gave a speech entitled "Let's Speak Up," urging engineers to realize the many benefits received by living in America.

CANADA ADDS ANOTHER ASTE CHAPTER

President McMillen presents Ottawa Valley's new charter to the chapter officers at recent installation ceremonies attended by 80 members. Shown from left to right are: Mr. McMillen; Frederick J. Crook, chairman; Mark M. Hannaford, first vice chairman; D. J. Moore, second vice chairman; William D. Boyd, secretary; and F. A. Davis, treasurer.

Ottawa Valley chapter celebrated charter night June 27, when it officially received its charter from National President Howard C. McMillen following his talk on the organization, purpose and growth of ASTE during the past twenty-four years. Past President R. B. Douglas acted as chairman for the evening. Frederick J. Crook, past chairman of Toronto chapter, who has been acting as temporary chairman since the original group began to organize, was presented with the chairman's pin by Gerald A. Rogers, past national director.

Marvin Bunting of national headquarters, and Gordon Hall of National Membership Committee attended.

At the conclusion of Ottawa's first official meeting guest speaker H. B. Callan, manager of the Eastern Ontario Development Association, gave an informative talk on industrial development throughout the Ottawa area.

members on the MOVE

Ray H. Morris & Co., Inc., of West Hartford, Conn., announces the appointment of **Howard A. Wheeler** as vice president in charge of sales and service for Connecticut. Mr. Wheeler, who is secretary of Hartford chapter, was formerly systems engineer for the Cutting Tool & Gage Div. of Pratt & Whitney, Inc.

National Education Committee Chairman **Robert E. McKee,** formerly associate professor of production engineering at the University of Michigan, is now training director of R. K. LeBlond Machine Tool Co. in Cincinnati.

Prof. O. W. Boston, 1956 ASTE Gold Medal Award winner and former member of the National Education Committee, has retired as chairman of the production engineering department of the University of Michigan.

Miss Paulena Pagel, first woman member of St. Louis chapter and member of its editorial committee, was recently installed as chairman of the Society of Women Engineers, St. Louis section.

K. J. Puffer of Detroit chapter is president and general manager of the newly formed Ajax Composite Die Co. He was formerly general manager of the Mound Road Div. of Ford Motor Co.

Another Detroit member, **Kenneth R. Fisher,** has been appointed President of Super Tool Co., Detroit subsidiary of Van Norman Industries, Inc. For the past eight years he has been sales manager and executive vice president of Super Tool Co.

National Book Committee Chairman **Francis J. Sehn,** vice president of Fran Sehn Co., is a member of the award committee for the 1955 annual Presteel Award established by the Worcester Pressed Steel Co.

Long Beach Hears Optical Tooling Panel

Kenneth M. Nelson of Optical Tool Engineering of Douglas Aircraft Co., acted as moderator at Long Beach chapter's panel discussion on "Latest Applications of Optical Tooling." After Mr. Nelson's brief history of optical tooling and resume of A.I.A. optical standards, Mr. Hamilton discussed "Optical Tooling Relative to Aircraft Major Jigs and Fixtures." Mr. Stolz reported on "Optics Relative to Machine Tools, Precision Equipment Alignment and Precision Inspection" and lastly, Mr. Partmess spoke on the subject of "Special Applications of Optics."

Affiliate membership plaques were presented to Gene Grant, owner of Omega Design Associates, and O. L. Rumble, tooling manager of Douglas Aircraft Co., Inc.

On June 6, seventy members of the Long Beach chapter and their wives toured the fabricating plant of C. F. Braun Co. Excellent administration and engineering facilities were noted.

—Dan Welty

Quality Control Talks At Lehigh Valley

Clifford W. Kennedy, quality control engineer and training supervisor for Federal Products Corp., addressed the May meeting of Lehigh Valley in conjunction with ASQC at Hotel Traylor, on quality control. Mr. Kennedy pointed out that through the utilization of quality control and instrumentation many advantages can be obtained: quality of product, savings in manufacturing costs, and greater accuracies as compared to hundred percent physical inspection. He also showed pictures of automatic gaging.

Special guests at the meeting were David Roberts, chairman of ASQC; and Robert Ickes, program chairman of ASQC.

On June 15, the annual "ladies night" was held, with members of Lehigh Valley acting as hosts to their wives and friends.

The evening started with a reception at which Samuel Kuba and Carl Occelletto of the program committee presented each lady with a favor. Following the refreshment and snack hour, the group adjourned to the Jade Room for dinner, where they listened to the music of Ginger Sharkazey and his band. Master of ceremonies George Savitz led the 54 couples present in group singing.

After a short intermission, there were dancing, relaxation, and an hour-long floor show presented by the musicians.

LEHIGH VALLEY—An added attraction at ladies night was a trio flown in from south of the border, who led the band in a rhumba. The lively trio included from left to right: Vincent Scalese, chairman of the chapter; Mrs. George Savitz, wife of the second vice chairman; and Bruce A. Schaller, editorial chairman.—*Bruce A. Schaller*

Nebraska Elects

Harley Bair was elected second vice chairman of Nebraska chapter to replace Herbert Bro who has recently moved to Denver, Colo. to be with Sundstrand Aviation.

Forty-nine members were present at Nebraska's June meeting held at Birchwood Club, at which Mr. S. E. Beer, of The Monarch Machine Tool Co. spoke.

—Walter P. Larson

Greater Lancaster Tours Razor Plant

Thomas Garry, vice president in charge of manufacturing of Schick, Inc., led 172 members and guests of the chapter on a plant tour June 12. After describing the history of the company, Mr. Garry illustrated, with the aid of models, the development of the present-day razor, and guided the tour through the entire plant.

—Harry E. Medsger

Wichita Students Hold First Annual Banquet

Paying special tribute to its Wichita parent chapter, the student ASTE group at Wichita University held its first annual banquet on May 24. Officers and committee chairmen and their wives were honored guests. Orville B. Strahm, area captain of the National Membership Committee was also in attendance.

Following installation of student officers pro tem, the principal speaker of the evening, Kenneth Razak, dean of Wichita's School of Engineering, addressed the group on "Contributions of Engineering to Our Economy."

Harold Shigley, faculty advisor since 1952, gave a review of student group's activities and development.

New pro tem officers are: John McCool, chairman; Hubert Brockman, first vice chairman; James Shafer, second vice chairman; Gene Maxon, secretary; Robert Moffett, treasurer; and Bernard Schultz, parliamentarian.

Entertainment by a coed vocal trio rounded out the program.—*John McCool*

WICHITA—Wichita University student group and members of Wichita senior ASTE chapter took part in the student's first annual banquet. Members, wives and girl friends are shown enjoying the festivities.

Massachusetts Group Makes Guided Tour

Sixteen guides conducted Southeastern Massachusetts chapter on a tour of Foxboro Co. The 130 members found the tour of this progressive company's operations interesting and noted particularly the company's management policies and organization methods.

—*Edward L. LaBroad*

AKRON—National President Howard C. McMillen, left, pauses to inspect a machine during a recent tour of Portage Machine Co. conducted by Akron Chairman Thomas Seidell. Also studying the machine are, from left: Headquarters Staff Administrator Marvin Bunting; Earl M. Patterson, president of Portage; and Wesley Novkov, vice president of the company.

Mid-Hudson Awards Handbooks to Students

Presentation of four copies of *Tool Engineers Handbook* for distinction in physics has been announced by Chairman Frank Plotnik of Mid-Hudson chapter. The handbooks were awarded to one graduating student in each of the following Mid-Hudson Valley high schools: Poughkeepsie, Arlington, Wappingers Falls and Roosevelt.

The 200 persons attending Mid-Hudson's annual family day picnic had an excellent time despite the rain. Rain has been an uninvited guest at nine of the ten picnics Mid-Hudson has held. Hot dogs, hamburgers and roast beef were consumed in quantity, and members played softball until the rains came.

Preliminary plans were laid by the executive committee for the chapter's tenth anniversary meeting in November. It will be combined with management night, and past chairmen, as well as representatives of local manufacturing concerns, will attend.

—*Attila G. V. dellly*

Obituaries

George R. Ahrens of Long Island chapter, tool inspector at Grumman Aircraft Engineering.

Thomas A. Moormann of Detroit chapter, plant manager of the forging and casting division of Allegheny Ludlum Steel Corp.

James M. Murray of Detroit chapter, chief tool engineer at Shwayder Brothers Inc.

Joseph H. Walter, Jr. of Philadelphia chapter, vice president and treasurer of Jackson-Walter Co.

Adhesive Bonding Panel At Long Beach Meeting

At Long Beach's July meeting held at the Petroleum Club, C. L. Sullivan of Douglas Aircraft Co. was moderator of the technical panel discussion on "Tooling for Adhesive Bonding."

After giving a general talk on the uses of adhesive bonding, Mr. Sullivan turned the microphone over to the three other panelists: C. E. Blankenship, process engineer at Long Beach Plant of Douglas Aircraft Co., Inc.; C. K. Fredericks, associate director of research and development at Narmco, Inc.; and G. J. Walkey, manufacturing engineer at Lockheed Aircraft Corp.

An additional highlight of the meeting was the announcement of the following scholarship winners: class A, high school seniors, included: first, Daniel J. Sarne; second, Gary L. Winterburn; and Gary M. Crase, alternate.

Class B, first year college students over 20 years of age, included: first, Donald C. Fisher; second, John H. Hall; and Donald W. Ohmnemus, alternate.

Class C, first year college students under 20 years of age were: first, John W. Bronn; and alternate, Earl J. Allee.

Direct Plating Discussed

Paul J. Topelian, vice president and director of research Tiarco Corp., spoke to eighty-five members of Long Island chapter at the Garden City Hotel. He described the process of direct plating practically all known metals with a highly ductile layer of chromium and showed samples to demonstrate the effectiveness of the bond. After describing a variety of applications of the process, Mr. Topelian challenged members to find additional uses.

—*Robert W. Bradshaw*

LOS ANGELES—Fred Peterson, right, receives golf trophy from Tournament Chairman Ollie Smith for being low gross winner of the annual chapter golf tournament. Other committee members responsible for the successful tournament were Paul B. Slater, Cliff Commeford, Roland Hamel, Al Beaumont, R. Conroy, Frank Long and Fred Berghausen.

Golf Tournament at Portland, Oregon

A host of spectators watched Portland, Ore. members participate in the third annual golf tournament held at the Broadmoor Golf Club. Prizes were won by the following chapter members: a trophy went to Gus Sahli; second prize to Vern Scholz; and third prize to Knute Lamzik. Longest drives were made by Paul Rulas and Norman Warner, and closest to pin was Vern Scholz.

There were some prize-winning golfers among the guests also: Howard Markison won first prize and Fred Whittlesey was low gross, while Paul Loett was closest to pin. —*Walter Brenneke*

Riverside Hears Talk On Investment Casting

James B. Price, sales manager of Arwood Precision Casting Corp., narrated a film on "Investment Casting" at Riverside's June meeting. He described the lost wax process in which his firm specializes.

After a lively discussion period, the group had an opportunity to examine sample castings which were on display. A proposal was made to have a field trip through one of these plants because so many of the members were interested in the lost wax process.

George Hildebrandt was awarded the "Member of the Year" pin for his fine work on the program committee for the past year. —*J. Kucera*

North Carolina State To Hold Tooling Conference

Piedmont chapter will sponsor its first on-campus conference on the subject of "Manufacturing Procedures in the Metalworking Industries" in cooperation with Raleigh-Durham chapter and the school of engineering's extension division of North Carolina State College on October 5 and 6.

Activities will center around Riddick Engineering Building on the North Carolina State campus. The first talk will be on "Modern Machining Practices" by Charles M. Reesey of The Cincinnati Milling Co.; and the afternoon sessions will include A. B. Alricht, metallurgical engineer of the Monarch Machine Tool Co., speaking on "New Concepts in Single-Point Turning"; and "Design and Maintenance of Small Dies" being the subject selected by a representative of the Western Electric Co. Still other sessions will feature George Moring of Jones and Lamson Co. speaking on "High-Speed Turning Setup and Tooling for Turret Lathe Production"; and a talk on "Tooling of Multislide Machines" given by a representative of the United States Tool Co.

North Carolina's engineering shops, computer center, and nuclear labs will open for tours.

A social hour and banquet are arranged at the Sir Walter Hotel in downtown Raleigh where Governor Luther H. Hodges of North Carolina will be the principal speaker.

The second day of the conference includes talks on "Precision Internal Grinding and Boring for Small or Large Lot Production" presented by Robert S. Hahn, chief research engineer of The Heald Machine Co.; and "Mechanical Finishing and Deburring" by the Roto-Finish Co.'s chief engineer.

At a special luncheon for students in the student union dining hall on Saturday Robert A. Blackburn P. E., of the Koppers Co. of Pittsburgh, Pa., will address the group on engineers in industry and the professional engineer.

Tours of several industrial plants in the Raleigh area are also arranged, and those who enjoy football can see the "Wolfpack" of N. C. State play the "Tigers" of Clemson College on Saturday in Riddick Stadium.

Toledo Holds Golf Party And Spring Frolic

Toledo's spring frolic and golf party was held June 27 at the Sunningdale Golf Club. Near-perfect golf weather accounted for the large turnout of members and their guests at this annual stag affair.

Concluding the party were dinner and entertainment at the club house.

—*Robert S. Bollin*

SYRACUSE—Shown conferring is the Syracuse program committee: Paul Hansel, Frank Conley, Chairman Andrew Lachner, Ernest Banks and Arthur Coville.

—*Paul Hansel*

Northwestern Ohio Tool Engineers To Meet at University of Toledo

University of Toledo's first Northwestern Ohio tool engineering institute conference will be held on September 29 on the subject of "Tooling and Gaging in Automation."

Conferees, consisting of plant managers, plant engineers, master mechanics, tool engineers, production and quality control engineers, industrial engineers, mechanical engineers, as well as technicians in production, inspection and planning, will be able to participate in discussion, hear outstanding speakers, observe demonstrations and visit exhibits throughout the day-long on-campus conference.

The program will begin with an early morning welcome by Dean E. D. Harrison, of the college of engineering at the university, who is to be introduced by Lewis C. Pascoe, chairman of ASTE's Toledo chapter. Mr. Harrison will introduce the panel members: Henry L. Boppel, supervisor of research engineering at Sheffield Corp., who will speak on "The How of Gaging"; Franklin Meyer, Jr., chief engineer of instrument gages at Taft-Peirce Manufacturing Co., whose subject is "The When"; and William C. Mullin, chief gage sales engineer of Pratt & Whitney Co., Inc., who will conclude the morning session with "The Why."

Herbert L. Tigges, past president of ASTE and sales consultant of the Buhr Machine Co., will moderate the conference.

To be introduced at the conference are Howard C. McMillen, ASTE national president, by Lewis Pascoe, and Mayor Ollie Czelusta of Toledo.

Following the midday break, there will be a tour of the exhibits in the university field house. Opening the afternoon session on the subject of "The Gilbert Computer" will be Jack Sieckmann of Metallurgical Products Department of General Electric Co., who will precede Harry Conn of ASTE's Chicago chapter, chief engineer of Scully-Jones and Co., speaking on "Toolholders and Presetting Fixtures Used in Automation."

Worcester Holds Joint Outing with ASM

Worcester chapter held its annual outing with the American Society for Metals. Chairman Leo P. Tarasov presided at dinner and turned the meeting over to Arthur Lawler, Jr., arrangements chairman, for distribution of awards.

Awards went to Paul Garlock, George Lyman and Robert Morrow in the hole-in-one contest; and to Fritz Fairbanks and Adam Kosciusko in the driving contest.

In the golf tournament, the blind bogie prize was shared by Jake DeJong and Paul Garlock; low gross was won by Edward Hogan and high gross by Arthur Hird. —*Leon F. Miller*

SAN FERNANDO VALLEY—Chapter Chairman Alfred T. Rando, left, listens carefully while Joseph H. Bungartz, western district manager of The Cincinnati Milling Machine Co., explains details of a milling head on model of a giant profile milling machine. Mr. Bungartz told the 100 members attending the July technical meeting what the immediate future holds for profile milling. —*A. J. Soares*

Members of the National Public Relations Committee held their first meeting of the new term at national headquarters on June 23. Directing discussion was Chairman Wilfred B. Wells, at the head of the table. Clockwise around the table are: Gloria F. McClure, assistant to the ASTE public relations manager; Keith Griffin; John A. Sheridan; George C. Bennett, vice chairman; William Moreland, national vice president and ex-officio member of the committee; Chairman Wells; Richard Gebers, ASTE public relations manager; Allan Ray Putnam, assistant ASTE executive secretary; Harry J. Todd, vice chairman; Robert L. Gay; and Clifford P. Farr.

Tour, Lectures, Picnic In Northern New Jersey

Northern New Jersey's spring program ended with a series of highly successful events. In April, 350 members attended an evening tour of the new Ford assembly plant in Mahwah, N. J. The chapter was the first large technical group to be granted an evening tour through this newest and largest assembly plant in the nation.

The Bellows Co. conducted the technical session in May with a two-hour program of discussion and films on "Practical Automation." William C. Richards, Jr., vice president in charge of sales, delivered the primary address.

The last event, concluding Northern New Jersey's spring activities was the annual picnic attended by 550 members. Although the weather was poor, everyone joined in the fun.—*John R. Cooke*

LONG BEACH—Winners of Long Beach chapter's annual college scholarships gather around chapter officers after awards were announced. Seated are, from left: Chapter Chairman Raymond E. Gariss; John D. Sprinkle, instructor at Long Beach City College; and James H. Medford, first vice chairman. The scholarship winners, from left, are: Donald C. Fisher, John W. Bronn, John H. Hall, Gary L. Winterburn, Gary M. Crase, and Daniel J. Sarne. Not shown are Donald W. Ohmnemus and Earl J. Allee.

Tooling Institute Scheduled at Wisconsin

A three-day tool engineering institute will be held at the University of Wisconsin, Monday, Tuesday and Wednesday, Sept. 24-26.

Although all speakers are not yet finalized, the program has been set up and will offer a wide variety of topics vital to tool engineers.

Monday's program starts with a session on "Tooling Metallurgy or Selection of Materials for Tooling" by a representative of Columbia Tool Steel Co. Another session before lunch is on "Ceramic Tooling" by a representative of Warner & Swasey.

Monday afternoon will offer "Plastic Tooling" by a representative of Kishresin, Inc., as well as a session on "Tooling for Automation."

Monday evening there will be a dinner meeting with a representative of Metallurgical Products Department of General Electric discussing "New Trends in Tooling."

Tuesday will feature "Toolroom Operation" with tool storage and tool identification covered by A. O. Smith Corp. engineers. Also on Tuesday "The Economics of Machine Replacement" by J. F. Fowler of the Falk Corp.; "Use of Simplified Drawing in Tool Engineering Work" by a General Electric staff member; and "Laboratory Inspection—Its Relationship to Production Quality" by B. D. Witemeyer of The Sheffield Corp.

The full program adjourns Wednesday noon after a morning-long panel discussion on "Jig, Fixture and Die Design and Die Making" with panel members from A. O. Smith Corp., The Trane Co., Line Materials Co., and Graber Manufacturing Co. S. K. Rudorf will represent A. O. Smith Corp.

New Haven Member Honor Graduate

New Haven chapter is proud to report that its scholarship recipient, Tadeuz Rybak, graduating from New Haven College with an Associate Degree in the Science of Mechanical Engineering, won both the Honor Diploma and Annual Award of New Haven College Engineering Society as the most outstanding engineering graduate.

Unfortunately, Mr. Rybak was unable to attend ceremonies due to illness, but his letter of regret describing his strong desire to learn and to progress in the face of what seemed overwhelming difficulties when he arrived in this country six years ago, so impressed the college that commencement exercises opened with the reading of this letter.

Positions Available

PROJECT ENGINEER—excellent opportunity for M.E. experienced in planning and estimating costs of parts and tooling. Familiarity with design and operation of progressive dies. San Francisco manufacturer, steady employment, progressive and expanding company, international distribution, modern plant and equipment. Excellent company benefits. Please state age, education and minimum salary requirements in first letter. Include detailed resume of experience. Schlage Lock Co., P.O. Box 3324, San Francisco, Calif.

TOOL DESIGNERS—one experienced in designing progressive dies for high volume production. One experienced in designing jigs, fixtures, gages, rotary indexing fixtures and automated assembly fixtures for high volume production. San Francisco manufacturer, steady employment progressive and expanding company, international distribution, modern plant and equipment. Excellent company benefits. Please state age, education and minimum salary requirements in first letter. Include detailed resume of experience. Schlage Lock Co., P.O. Box 3324, San Francisco, Calif.

Position Wanted

SALES MANAGER or PRODUCT MANAGER—for Machine Tool builder or similar manufacturer. ASTE member. Past experience, over 20 years, includes substantial amount of personal selling and nearly every phase of sales management. Write to Box 086, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

DETROIT—More than 350 chapter members and guests toured the Willey's Carbide plant on June 7 and enjoyed a buffet dinner. Inspecting a form grinder are, from left: Ralph Johnson, William Giwa, L. E. Gallagher, Vic Kajewski and Ed Krysiak, operator of the machine.

coming ASTE meetings

National

SEMIANNUAL MEETING—of National ASTE Board of Directors, Oct. 25-26, The Greenbrier, White Sulphur Springs, W. Va.

NATIONAL EDUCATION COMMITTEE—Sept. 7-8, Statler Hotel, Detroit.

NATIONAL PROGRESS COMMITTEE—Sept. 22-23, National Headquarters, Detroit.

ANNUAL NOMINATING COMMITTEE—Sept. 22-23, National Headquarters, Detroit.

Conferences

UNIVERSITY OF TOLEDO—First Northwestern Ohio Tool Engineering Institute, Sept. 29. Theme: "Tooling and Gaging in Automation."

UNIVERSITY OF WISCONSIN—Tool Engineering Institute, Sept. 24-26.

Chapter

ANN ARBOR AREA—Sept. 19, 7 p.m., American Legion Post. Plant tour of Hoover Ball & Bearing Co.

BOSTON—Sept. 13, 6:30 p.m., Normandie Room, Norumbega Park. General Electric Co. speaker on "Automation."

BUFFALO-NIAGARA—Sept. 13, 6:30 p.m., Lamm Post, Williamsville. Don Mosher, president, BMT Mfg. Co., "Multi-Barrel Slide Honing."

CALUMET AREA—Sept. 22, South Shore Country Club, Cedar Lake. Second annual golf outing.

CEDAR RAPIDS—Sept. 13, 6:30 p.m., Collins Radio Co. Plant tour.

CLEVELAND—Sept. 14, 8 p.m., East Side Turner's. "Multiple Head Drilling" by Frank Zagar, president, Zagar Tool Co.

COLUMBUS—Sept. 12, 6:30 p.m., Fiesta Club. Tour of Seagrave Corp.

DAYTON—Sept. 10, 7:30 p.m., National Automatic Tool Co., Richmond. Joint dinner meeting with Richmond ASTE chapter.

DETROIT—Sept. 13, carbide section, plant tour of Elox Corp. Technical section, Sept. 20. Education section, Sept. 27, "Automation (Package Units)."

ELMIRA—Sept. 10, 7 p.m., Mark Twain Hotel. Sportsmen's night, indoor clambake, film "Rubber Made from Rock" by Dow Chemical Co.

GOLDEN GATE—Sept. 18. "The Radial Drill as a Drilling and Boring Machine" by John Hussey of American Tool Works.

GRAND RIVER VALLEY—Sept. 8, Waterloo Fish & Game Club. Field day.

HAMILTON DISTRICT—Sept. 14, Timken Roller Bearing Co., Ltd., St. Thomas. Plant tour.

HOUSTON—Sept. 11, 6:30 p.m., W.K.M. Valve Mfg. Co., Div. of ACF, Missouri City. Plant tour.

INDIANAPOLIS—Sept. 6, 7:30 p.m., Antler's Hotel. "Powder Metallurgy" by B. T. Pollins, director of research, Raybestos Manhattan.

WENTWORTH INSTITUTE—Looking over the student chapter display at the institute's recent open house are Charles W. Moody, faculty advisor, left, and Robert A. Cusson, chairman of the Wentworth student group. *—Carl T. Fritzsche*

JACKSON—Sept. 17, 7 p.m., West End Grill. "Tool Steels and Their Uses" by Joseph Pendleton, metallurgist, Carpenter Steel Co.

LANSING—Sept. 10, 6:30 p.m., Charcoal House, Frandor Center. Speaker: Dick DeStefano, Detroit area manager, Micro Switch Corp.

LEHIGH VALLEY—Sept. 21, 6:30 p.m., dinner at Hotel Traylor, Allentown. "Ceramic Tooling" by James Edge, service engineer, Sintox Corp., at 8 p.m.; tour of plant at 10 p.m.

LITTLE RHODY—Sept. 6, 6 p.m., dinner at Johnson's Hummocks, followed by tour of Brown & Sharpe Mfg. Co.

LITTLE ROCK—Sept. 13. Plant tour of Ben Pearson Co.

LONG ISLAND—Sept. 10, 8:30 p.m., Garden City Hotel. "Milling of Aircraft Skins" by J. Dougherty, staff vice president, Giddings & Lewis Machine Tool Co.

LORAIN COUNTY—Sept. 5, 7 p.m., Sheffield Restaurant. Film, "Care and Use of Grinding Wheels," by Peninsula Grinding Wheel Co.

LOS ANGELES—Sept. 13, 7 p.m., Scully's. "Applications of Titanium" by George T. Fraser, western sales manager, Rem-Cru Titanium, Inc.

MERRIMACK VALLEY—Sept. 15, Wentworth-by-the-Sea, Portsmouth. All-day outing, clambake at 5 p.m.

MID-HUDSON—Sept. 11, 7 p.m., The Mirabel, Poughkeepsie. "How the Tool Engineer Can Use Silicones" by Dow Corning Corp. representative.

MILWAUKEE—Sept. 13, 6:30 p.m., Serbian Memorial Hall. Speaker: Joseph Pendleton, plant metallurgist, Carpenter Steel Co. Open forum.

MONADNOCK—Sept. 20, 7:15 p.m., Kingsbury Machine Tool Corp. cafeteria. "Work Simplification" by Prof. George A. Taylor, Thayer School of Engineering, Dartmouth College.

MUNCIE—Sept. 14, 6:30 p.m., Warner Gear Div., Borg-Warner Corp. Plant tour, welcome by W. H. Cortwright, vice president and works manager.

MUSKEGON—Sept. 11, 7 p.m., Spring Lake Country Club. Ladies night.

NASHVILLE—Sept. 18, 6 p.m., Aladdin Industries, Inc. Tour. Speaker: N. S. Schaumann, chief engineer.

NEBRASKA—Sept. 22, 7 p.m., Birchwood Club, Omaha. Ladies night, dance.

NIAGARA DISTRICT—Sept. 6, 6:30 p.m., Queensway Hotel, St. Catharines. "Automation in Canada" by C. P. Farr, manager, special machine sales, Standard Modern Tool Co., Ltd.

NORTHERN MASSACHUSETTS—Sept. 18, 7 p.m., Lithuanian Citizens' Club Hall, Athol. "Developments in Ceramic Tooling" by Raymond Jablonski, field engineering chief, ceramic tools, Metallurgical Products Div., General Electric Co.

ASTE meetings

(continued)

NORTHERN NEW JERSEY—Sept. 11, 8 p.m., Hotel Robert Treat, Newark. "Flow Turning" by William H. Busch, associate of Lodge & Shipley Co.

PHILADELPHIA—Sept. 20, 7:30 p.m., Engineers Club of Philadelphia. Dinner at 6:15. "Automation—Is It for You? Your Product? Your Company?" by representative of National Automatic Tool Co.

PHOENIX—Sept. 10, 7 p.m., Westward Ho Hotel. "Economics of Tooling and Manufacturing" by Harry Conn, Scully-Jones and Co.

PORTLAND, ORE.—Sept. 20, 7:30 p.m., Willamette Iron and Steel Co. Tour conducted by Fred Mondin, general superintendent, and staff.

ASTE 25th Annual Meeting (Silver Anniversary) will be held March 25-27, 1957, at Houston, Texas.

SAGINAW VALLEY—Sept. 20, 7 p.m., Zehnder's Hotel, Frankenmuth. "Engineering the Tools of Communist Conquest" by Dr. Fred C. Schwarz.

ST. LOUIS—Sept. 5 & 6, 7 p.m., A. O. Smith Co., Granite City. Tour of new automated automotive frame plant.

SAN DIEGO—Sept. 11, 7 p.m., El Morocco Club. Smoker.

SAN FERNANDO VALLEY—Sept. 5, 7 p.m., Hody's Restaurant. "Industrial Application of Atomic Energy" by Dr. Lester E. Reukema, professor of electrical engineering, University of California at Berkeley.

SCHUYLKILL VALLEY—Sept. 11, 6:30 p.m. "Modern Carbide Turning for Large and Small Lot Production" by S. A. Brandenburg, vice president, Monarch Machine Tool Co.

SOUTHEASTERN MASSACHUSETTS—Sept. 18, Cotillion Room, Taunton. "How To Make Taps Cut the Buck" by Harvey F. Phipard, Hy-Pro Tool Co.

SPRINGFIELD, MASS.—Sept. 15, Strathmore Park, Woronoco. Steak roast.

TRI-CITIES—Sept. 5, 6:30 p.m., Rock Island Arsenal Cafeteria. "Barrel Finishing" by E. R. Stevens, abrasive polishing engineer, Norton Co.

WORCESTER—Sept. 11, 6:30 p.m., Oyster Cabin, Uxbridge. "Design and Application of Air Gaging Instruments" by Franklin Meyer, chief engineer, Instrument Gage Div., Taft-Peirce Mfg. Co. Visit to plant, 2:30 p.m.; social hour, 5:30 p.m.

NORTH TEXAS—Members of North Texas chapter's go-getting membership committee are setting a record to be proud of. Committee Chairman Mark Johanning, standing at left in front with Director-Elect Irving H. Buck, reports an increase of 80 members, bringing the chapter over the 400 mark in membership. Other committee members are, back row, from left: Collins Conquergood, Clair Knight, Wayne Johnson and Ed Wood; third row, Sherman Burt, Bill Watson, Clay Martin and Bill Best; second row; Bob Espeset, Dennis Morgan, Reid Jamison, Dauls Wyse and Joel Rubel.

Santa Clara Valley Welcomes New Members

Chairman W. T. Wright of Santa Clara Valley chapter presented membership pins to four new members: George Ingram, Food Machinery and Chemical Corp.; John Bean, Western Div.; Robert Brown, Pratt and Whitney Co.; George Lukasko, Lukasko Machine and Welding; and Tom Krumholz, The DoAll Co.

Program Chairman J. S. Burnett announced plans for a tour of the San Francisco Naval Shipyard.

—W. H. Forbes

Selective Service Talk

"Manpower Utilization—Military versus Industry" will be discussed Sept. 20 at the Engineering Society of Detroit by Col. Arthur A. Holmes, Michigan Selective Service director.

Co-sponsoring the meeting are ASTE's Detroit chapter and the State Selective Service Advisory Committee on Scientific and Other Specialized Personnel.

Frederick G. Beattie, regional director, U.S. Dept. of Labor, will explain reemployment rights of servicemen under the 1955 amendment to the Selective Service law.

Evansville Members Enjoy Picnic, Games

A fine chicken dinner was enjoyed by Evansville chapter members at their picnic at Ruthenburg Field. Cards, horseshoes and other games were played, and each member received a gift.

At their June technical meeting members heard C. Randolph Myer, general manager of the Abrasives Div. of Elgin National Watch Co., discuss the merits of the natural and hardest abrasive—the diamond.

Beginning with a brief history of the stone, he went on to explain faults of improper techniques of grinding and what to look for in a properly ground piece.

Robert Fair, now an attorney in Princeton, Ind., gave an interesting coffee talk on some of his adventures as an FBI agent. *—Gerald L. Lykken*

Annual Field Day At Niagara District

Approximately 250 members and their guests enjoyed Niagara District's twelfth annual field day and golf competition June 23 at Chippewa Golf Club.

Under the direction of Walter Pentesco and F. Dunn, games, putting, fly casting, and any number of other activities flourished, for which outstanding contenders were awarded prizes.

Harry Nesbitt was the golf trophy winner of this annual field day, with a low of 69. *—F. W. Bird*

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• **Standards.** Vascoloy-Ramet manufactures and stocks a complete line of standard cemented carbide blanks for solid and tipped cutting tools . . . wear parts . . . punches . . . dies . . . gages . . . bushings . . . guides . . . mandrels . . . lathe centers . . . chisels . . . router bits . . . end mills . . . and hundreds of other items.

Specials. V-R produces custom made carbide blanks for flat and circular form tools and all special cutting tools and wear parts.

Grades. V-R standard grades of cemented carbides will fit most applications.

Quality. V-R advanced manufacturing and control procedures assure you of consistent uniformity of product.

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Leader in the Manufacture
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PROGRESS IN PRODUCTION

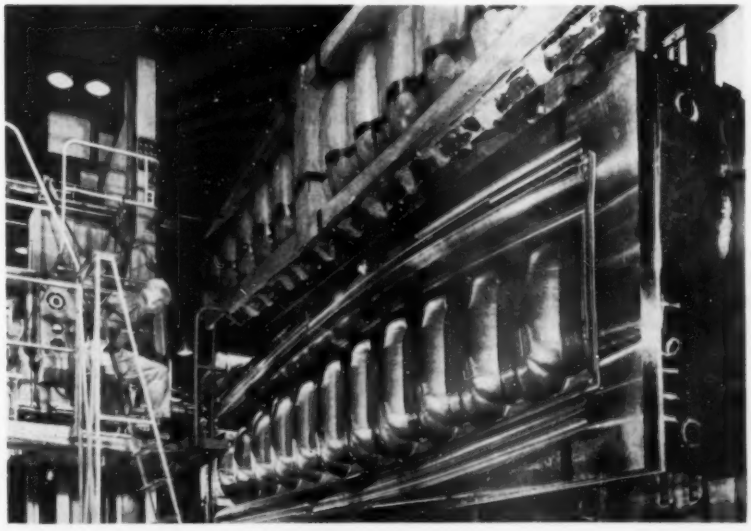
PRODUCE LARGEST CLOSED DIE FORGING

A massive 3,000-lb aluminum airframe member, produced on the Air Force's 50,000-ton press, is the largest closed die forging ever produced. As it comes from the dies, it measures 13 ft in length, 3 ft across at the widest point, and a foot in thickness. The forging, made by Aluminum Co. of America for the Martin Co., will be part of the airframe and help form the backbone of the fuselage and wing structure in the XP6M SeaMaster, first multi-jet seaplane.

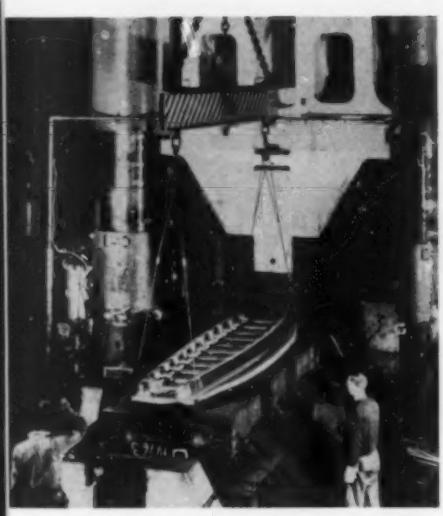
Achievement of the mammoth forging makes possible a substantial weight reduction with a consequent expected increase in performance level of the aircraft. In a single unit, the forging offers a part formerly assembled from many smaller components. By doing away with need for previously required joining operations, savings of both time and money have been realized.

In preparation for attempting the forging, Alcoa's Cleveland works die shop first had to sink the world's largest dies. Working from Martin Co. specifications, plaster models of the proposed dies were formed. This involved two sections to minimize distortion because of their exceptional size. Each was mounted in turn on a die sinking ma-

Work also involved sinking a 30-ton closed die, involving about 1500 man hours per die half. Plaster models of the die cavity were made in two sections and mounted one at a time on the die sinking machine. Electrical impulses, transmitted by a tracer arm (above and left of center) as it follows the model's contours, guides the machine's cutting tool in etching the die block below.



The finished forging weighs 3000 lb, is 156 in. long, 36 in. wide and 12 in. thick.



Temporary use of an overhead crane is required to remove a 3000-lb aluminum section from the mammoth press.

chine. Electrical impulses, transmitted by a tracer arm following the contours of the models, guided the machine's cutting tool to etch the dies.

From a set of rough forged armorplate steel die blocks weighing 75 ton, a set of 60-ton finished dies were produced. In the operation, 15,000 lb of metal were machined from the blocks prior to mounting on the die sinking equipment. The rest was whittled away during the actual sinking operation and in milling the key and toe-clamp slots. Several months were required to engineer and produce the dies; sinking and finishing operations for each die involved 1500 man hours.

'SHORT-ORDER' STEEL

It is possible to fill an order for stainless, carbon or alloy steel within 99 hours with this electric arc furnace. According to National Carbon Co., manufacturer of carbon and graphite

electrodes for electric arc furnaces, their versatility of these units permits a relatively few electric furnace steel mills in the United States to serve numerous customers with widely divergent and constantly changing material requirements.

TUNGSTEN CARBIDE DIES REDUCE STAMPING COST

In applications where consideration of high part quality, and efficiency and low reject considerations have preceded long production runs in importance, specifying of tungsten carbide have proved advantageous for the Standard Control Div. of Westinghouse Electric Corp.'s plant in Beaver, Pa. The plant produces industrial circuit breakers that incorporate numerous intricate metal stampings. Some of the parts are made from mild cold rolled steel and others are stamped from stainless or hard, abrasive, electrical silicon sheet steels.

In the past it has been necessary to make the dies of high carbon, high chrome or high-speed steel. Although these dies have given satisfactory performance, many dies for the same part were required to meet production schedules to continue work while dies were out of production to be sharpened. At times as many as six dies were necessary to maintain production.

Consultation between Westinghouse tool engineers and engineers from

In Defense or Peace

ECLIPSE Specials

. . . . ARE THE BEST BUY!

Eclipse Radial Drive High Speed Steel Cutter bores 5 diameters in steel part.
Special Cutter forms ball seat in road building machinery unit.
Tungsten Carbide Tipped Cutter precision bores three diameters in aluminum gear case.
Radial Drive Tungsten Carbide Tipped Cutter bores gear pocket in oil pump.
Multi-diameter cutter with Tungsten Carbide Tipped inserted blades for boring, counterboring and chamfering.

Since 1913—through two wars and during the peace years—Eclipse has met the exacting and changing demands of industry for special purpose end cutting tools. What better test? What better recommendation? Our large modern plant can serve you, too. Send your problem to us, today!

ECLIPSE COUNTERBORE CO.
Founded in 1913
DETROIT 20, MICHIGAN
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Oberg Mfg. Co., Inc. to determine the economic advantage of using tungsten carbide as a die medium for more difficult stampings, brought the conclusion that it should be applied first to a wear problem involving a relatively simple shape. Results would guide progress into more difficult work.

Among the first parts examined were a special "E" and "I" type lamination stamped from high content silicon steel and used as magnet and armatures in a contacter frame. High abrasiveness of this material and the assembly requirement of practically no detectable burr were conditions which could not be met without an inventory of many duplicate tool steel dies to minimize press downtime.

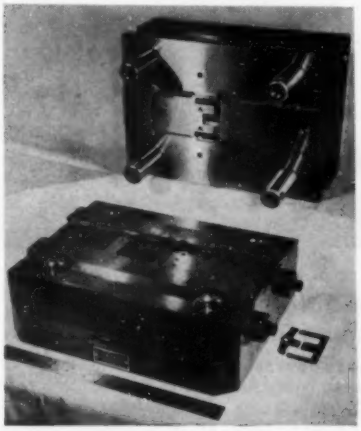
A progressive carbide die designed and built by Oberg for this operation, although costing initially three times as much as a tool steel die, in production turned out more than 18 times as many laminations between sharpenings. Practice at Westinghouse now is to sharpen the die at the end of 500,000 strokes.

It has been found that tungsten carbide holds a sharp cutting edge over long periods of use. A small circuit breaker catch bracket 1/16 in. thick is stamped from half hard cold rolled steel. The part was formerly produced by blanking with a tool steel compound die and grinding the operating edge of the part as a second operation. Time required for this was 0.00037 hours to pierce and blank, and 0.00200 hours for grinding. This made a total of 0.00237 hours for an optimum output of 420 per hour.

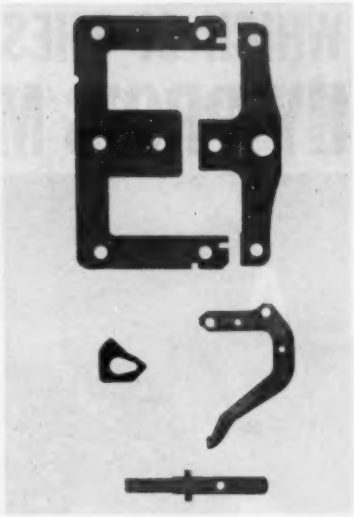
Because a carbide die's cutting edges stay sharp longer, it was found feasible to close in the break clearance, getting a cleaner cut, and discontinue the subsequent grinding of the operating surface. With this change, total blanking time was reduced to 0.00028 hours or one second per part, resulting in a total theoretical output of 3600 parts per hour.

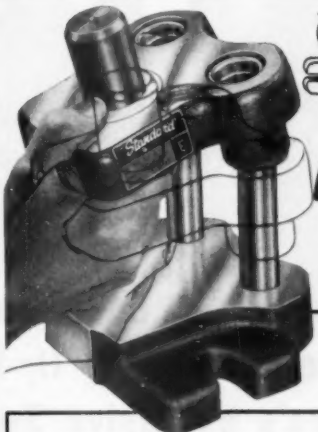
An increase in output was not the prime consideration in production of a small flat push rod stamped from stainless 1/16 in. thick. Major problem involved piercing a hole 0.072 in. in diameter through the center of the part where overall width of material is only 0.184 in. Rejects were high because of cracks developing across side walls of the hole. A tungsten carbide die speeded output more than 225 percent, but more importantly, held rejects to a minimum.

Progressive die, designed by Oberg for Westinghouse, is used for blanking E and I laminations from high silicon steel.



These intricate parts are stamped with carbide dies. At top are the E and I laminations; in the center are catch bracket and trip latch, and a push rod lies below.





Stan the Die Set Man Says . . .

END DIE SET ASSEMBLY STRUGGLES

with the NEW McVEY-DESIGN® "Standard" precision post

- No Hammering or Tapping
- No Jamming • No Binding
- No Costly Assembly Slow-Downs

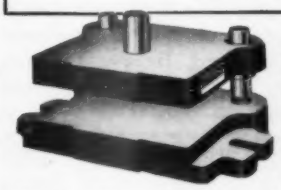
HOW THE McVEY® POST WORKS

1. Ground Taper Eases Punch Holder Onto Post
2. Special "Controlled Width" Land of Same Diameter as Post Proper—To Insure Long Wear
3. Pivot Plane of Punch Holder Bushing
4. Clearance Area for Punch Holder Bushing
5. Ground Lead

This time-saving improvement, first applied to die sets several years ago by C. H. McVey, noted tool and die engineer, is now available for immediate delivery. The McVey design shown in the diagram is for 2 post die sets — design variations are available for 4 post sets.

Combined with Standard's constant-diameter, chrome-coated posts and full-bearing bushings, this design insures the ultimate in die set performance and assembly ease.

All these outstanding features are yours at prices competitive with ordinary die sets.



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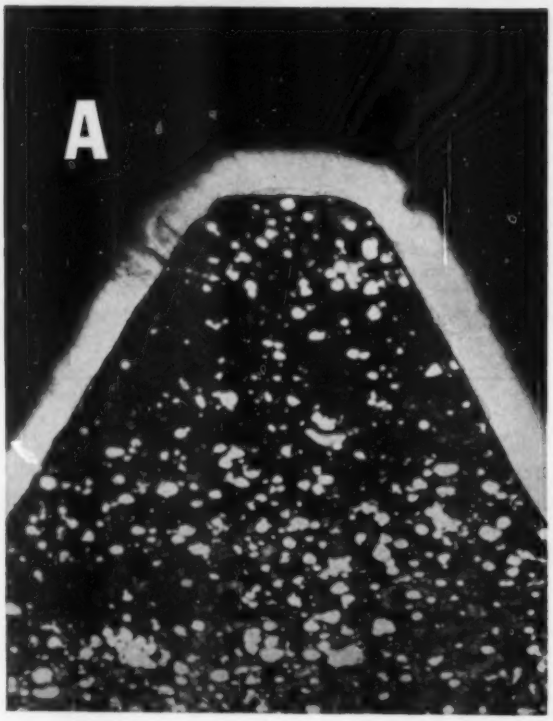
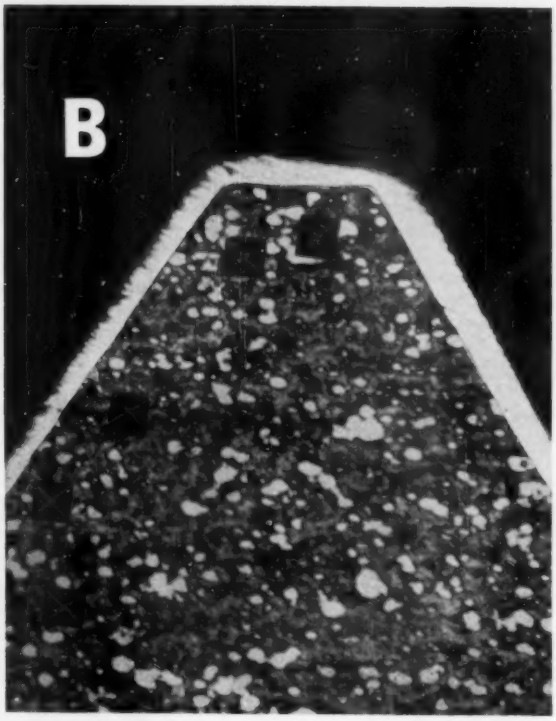
WHICH OF THESE TAP SURFACES WAS REJECTED BY HY-PRO'S MICRO-HARDNESS TESTER?





The flaws in Tap A were revealed by Hy-Pro's Micro-Hardness Tester—part of Hy-Pro's exclusive 3-way Quality Control!*

THE machines that grind a tap surface can generate a great amount of heat. Without Hy-Pro's control, this heat can burn and soften the tap, weakening it to a serious extent.

Such weakening is invisible to the naked eye. But Hy-Pro's Micro-Hardness Tester reveals the extent of the flaw every time! What does this mean to you? Productivity per tap has been increased by 20 to 25 times through the selective work of Hy-Pro's Micro-Hardness Tester. And that means time and money saved on your production line.

The Micro-Hardness Tester is an important part of Hy-Pro's exclusive 3-way Quality Control, which guarantees you the finest taps in the world. Incidentally, the Hy-Pro Micro-Hardness Tester is the only known microscopic hardness examination for both interior and exterior surfaces. Even the tap's cutting edges are checked down to half a thousandth of an inch.

If you would be interested in taps by Hy-Pro—the Tap Specialists—see your nearest Hy-Pro distributor or call us direct. Believe it or not, Hy-Pro Taps cost no more than ordinary taps.

**The small dark squares are diamond impressions used in testing the structural strength.*

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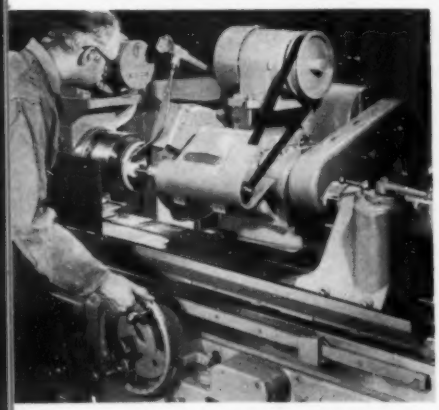
TOOLS of today

Universal Grinders

Type U-4 14 in. and 18 in. universal grinding machines are designed to assure fast setups and rapid action in performing external, internal and angular grinding operations on large workpieces.

In changeovers involving chucking, internal, or dead center grinding, setup is particularly fast. A chuck can be permanently mounted on the U-4. A 6



in. D-1 cam lock nose on one end of the headstock takes chucks or special fixtures, and the other end is equipped with a dog drive plate for conventional grinding on centers. To change from conventional to chucking grinding, only the headstock is swivelled 180 deg.

Advantage of permanent chuck mounting combines with that of the hinged-bracket type internal grinding spindle to speed setups for internal grinding. Individually powered internal spindle may be quickly swung down into grinding position, or back to the inoperative position.

An infinitely adjustable work speed of 60 to 360 rpm is produced by mechanical means from an a-c source. Speed changes are made quickly by a small hand wheel on the headstock.

The wheel head has a double swivel, one above and one below the slide ways, to permit independent angular settings of grinding wheel position and grinding wheel feed.

The automatically lubricated wheel spindle is a plain bearing type in which the long bearings enclose practically the entire circumference of the spindle and support over 50 percent of the spindle body. With this spindle, either heavy cutt[illegible] to fine finishing may be done.

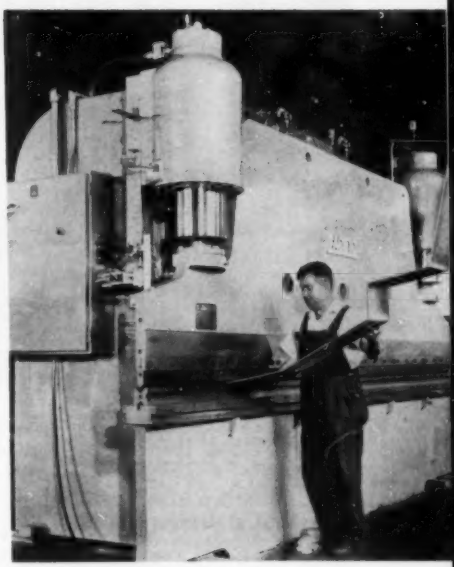
A [illegible]bination lever and hand wheel oper[illegible] footstock is supplied as standard. In lever operation, the footstock spindle will remain in the retracted position while loading.

Norton Co., Worcester 6, Mass. **T-9-1451**

Hydraulic Press Brake

Up to seven different angles may be formed in succession on this hydraulic press brake without resetting controls. All bends on a piece of metal are formed in one handling by presetting controls only once. Range is from 12-in. deep bends, formed in a single stroke, to bends of less than ⅛ in. with press cycling at 50 strokes per minute or more. Results are accurate to within thousandths of an inch.

Work can be done at any point along entire length of the bed. A piece can be passed progressively from die to die for blanking, deep drawing, embossing,



punching and forming. The unit also may be used for straightening, rubber pad forming, pipe making, stretching, extruding, hot forming, shearing heavy plates.

Pacific Industrial Mfg. Co., 848 Forty-ninth Ave., Oakland 1, Calif. **T-9-1452**

Automatic Double-End Machines

These automatic, high-speed, double-end machines perform either press forming or metal-removing operations on both ends of rod or tubular production parts from 1 to 24 ft long and up to 6 in. in diam.

Two hydraulic-powered motorized

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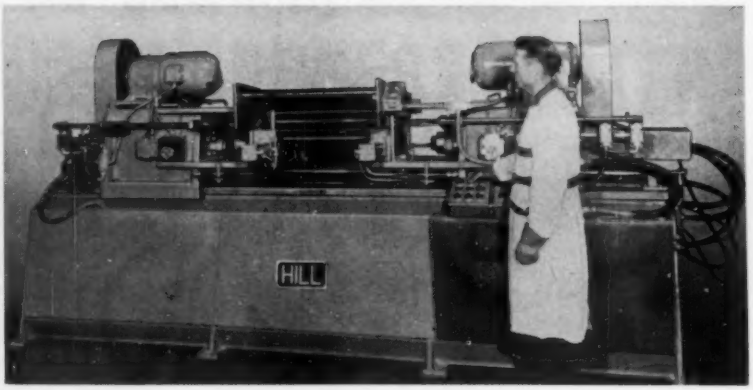

precision heads can develop up to 20 tons of thrust force each. Depending on the part size and operations performed, production rates range from 300 to 5000 pieces per hour. A length adjustment feature permits parts to be fed through the hydraulic-operated automatic magazine feed with or without the motorized heads turning. Without the heads turning, the machine can be operated like a forming press that will expand, reduce, flare or bead both ends of the parts simultaneously.

With the heads turning, the machines will burr, chamfer, face, spin, drill precision-bore or ream both ends of the parts simultaneously. These operations can be combined with forming and finishing operations.

Heads are individually controlled and have individual feed and stroke adjustments, enabling different types of operations to be performed on each end of the parts. Quills in each of the motorized heads have No. 40 milling machine taper noses.

Maximum work cooling is provided by the separate coolant supply system that feeds either heavy oils or light soluble coolants through the quills.

The 4-in. diam, 6-in. maximum stroke quills are powered with 5-hp, 4-speed motor drives. With the quills extended the 6-in. maximum stroke, they have 18 in. of bearing in the heads. A rapid advance feed is provided for the quills. Feed of the quill is variable up to 30 ipm.

Walter P. Hill, Inc., 22183 Telegraph Rd., Detroit 19, Mich. **T-9-1461**

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Hydraulic Power Pack

This power pack unit measures less than 9 in. in height, 6 in. in length and 4½ in. in width. It requires no mounting base and may be mounted horizontally or vertically anywhere. In vertical mounting position, the pump may be inclined as much as 45 deg in any direction from vertical.

The unit consists of an electric motor, a high-pressure low-volume pump, couplings, integral reservoir, automatic valving for cylinder actuation, optional pressure switch and mounting bracket.

It does not require separate solenoid valves, relief valves and reservoirs. Pressure up to 3000 lb is developed with 5000-lb peaks. Cylinder actuation is controlled through two oil lines between pump and cylinder. Two internal valvings are available: one locks cylinder in infinite holding position; the other allows free movement of cylinder except during actuation.

Oil-Dyne, Inc., 2117F W. Marquette Rd., Chicago 36, Ill.

Locking Device

Introduced as a substitute for staking, this Spherelock insert and mating screw offers economy, functional performance, is flush after installation and can lock and disassemble in a matter of seconds. It is applicable to all sizes and standards, including AN, NAS, MS and SAE. It may be used whever bolt, nut, washer and cotter pin are used. Rapid or intermittent temperature changes have no effect on its locking ability.

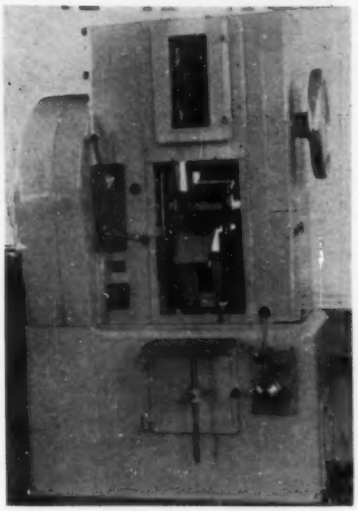
Bellford Metal Products, Inc., 5900 Maurice Ave., Cleveland 27, Ohio.
T-9-1463

Powder Metal Presses

One shot, central lubrication, a special volume controlled filler shoe mechanism, and a new core rod bracket are features of this line of presses designed to produce powder metal parts.

The lubrication system, controlled by an easy-to-reach lever, reaches 21 points in the press, including the clutch, main bearings, and all moving parts.

A special filler shoe is divided into two sections, a hopper and the shoe. The



mechanism is cam operated to deliver a predetermined quantity of powder to the shoe to assure uniform volume of material.

The new core rod bracket simplifies tool design by permitting use of short core pins attached to a stationary core rod. Access to this feature is quick and simple through a door at the front of the press. The equipment permits short set-up time and easy adjustments.

Depth of fill may be adjusted while the presses are running. Capacities of the presses range from 8 to 40 tons.

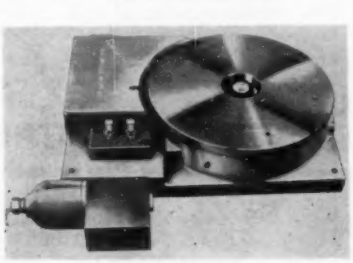
Haller, Inc., 684 Ann Arbor Rd., Plymouth, Mich. **T-9-1471**

Index Fixture

This hydraulically operated, electrically controlled index unit is designed for operation in a small space. Sub base measures 4¼ x 15 x 21¾ in. There are no gears, cams or mechanical pawls. There is no problem of backlash and, because of its smooth action, there is no danger of shock.

The unit can be synchronized with automatic cycling of the machine with which it works, and a precision limit switch assures safety in operation. The table top is flat and parallel within 0.0001 in.

The shot pin is held in place hydraulically for positive positioning of the



REED RTD

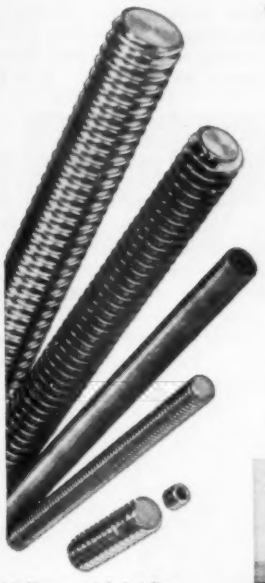
Thru-feed Thread Rolling

for Continuous Precision Threading of Long or Short Bars and Tubing and Short Headless Parts

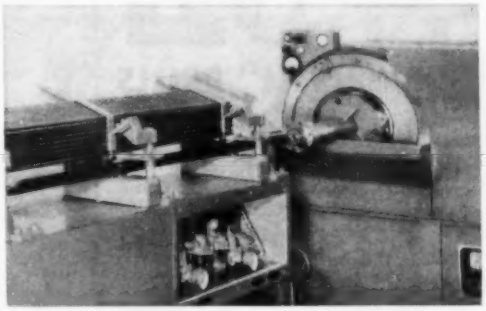
DIAMETER CAPACITIES—¼" to 3"

REED MACHINES

Provide Uniform Pitch Diameter and Accurate Thread Form Over the Entire Length of the Threads



Hollow and Solid Parts Threaded by Thru-feed Rolling



Thru-feed rolling may be used for threading both solid and hollow pieces of varying lengths and materials. Various forms may be rolled, including worms and Acme threads. Headless pieces, with threads running the entire length, may be threaded in bar lengths and then cut up into desired finished lengths.

Machines may be arranged for both manual and completely automatic loading and unloading of the parts . . . the rolling cycle with either method of loading is fully automatic. The work blank is rolled between cylindrical dies and is finally discharged at the rear of the machine. Short, headless pieces may be loaded into a chute and automatically fed, rolled and discharged. Controls are available that permit rolling the entire length, ends or middle section of a part.

Reed thread rolling machines are made in 2 die horizontal and 3 die horizontal and vertical types for thru-feed and in-feed rolling. They are rugged, of compact construction, easy to set up, convenient and simple to operate.

Operating handbooks are available so the tool engineer and operator can set up his own applications.

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table on any index from 3 to 120 deg to a tolerance of 0.0003 in., without accumulation on a 12-in. gaging diameter.

The 4-way valve and solenoid with spring return, which operates the fixture, can be mounted either to the fixture or on the machine. The valve has a check valve and flow control.

Center line taper adaptation in the fixture top makes all tooling interchangeable. The fixture can be furnished with or without setup blocks. Disassembly and reassembly takes less than 2 hours.

Automation Mfg. Corp., 8070 Wheeler Ave., Detroit 10, Mich. **T-9-1481**

Notching Tool

This bench type hand metal notcher, the Whitney-Jensen No. 100, has capacity to cut a 90-deg notch 4¼ in. deep in 16-ga mild steel.

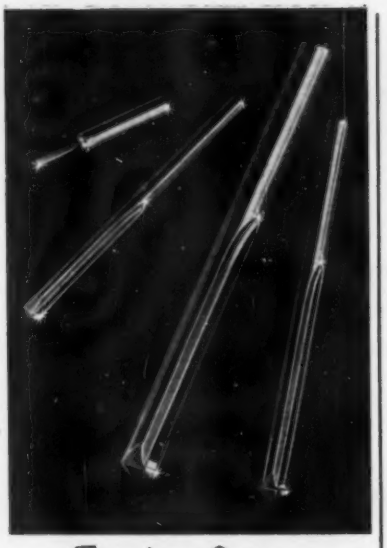
Blade of the unit is operated by a hand lever and eccentric-pivoted link which deliver cutting power to the blade, which is 6 in. long on each side, through a V-ram that has adjustable ways to insure positive blade and die alignment. Design minimizes friction. The lower die is quickly and easily adjusted when necessary.

The tool will do various cutout or cut-off operations on corners as well as producing 90-deg notches of any depth up to capacity. Guides with 90 and 45-deg sides are fully adjustable close to both cutting edges.

WhitneyMetal Tool Co., Rockford, Ill. **T-9-1482**

Magnetic Cylinder Square

With this magnetic cylinder square it is possible to check squareness accurately in a matter of seconds. There is no need for clamping because the tool is designed so that magnets hold the face of the cylinder square to the surface to



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INDICATE A-9-148-1

NEW

HARDENED, PRECISION-GROUND BED WAYS

Now you can get South Bend Precision Lathes with hardened bed ways that have greater resistance to wear and scoring. This is particularly important if you are machining tool steels or metals which produce work-hardened chips. Also, rubber, plastics or other abrasive materials. This feature will give you even longer service and accuracy from your South Bend Precision Lathes—and the additional cost is only nominal. Hardened bed ways are available on all 10" and larger South Bend lathes.

SPECIFICATIONS—13" LATHES

Swing over bed 13⅛". Distances between centers 16" to 52" max. Collet capacity 1". 6, 8, 12 or 16 spindle speeds. Longitudinal, cross and threading feeds 48 each. *13" Lathe prices start at $1,533.*

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Builders of Lathes Milling Machines, Shapers, Drill Presses and Pedestal Grinders

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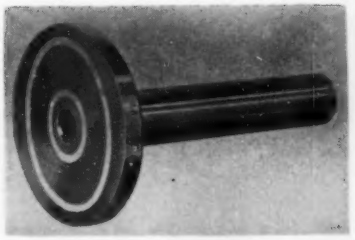

be checked. It can be used for any type of squaring operation and provides full 360 deg of squareness. Reworking to restore original accuracy is a simple process.

The tool is available in standard size of 3½-in. diam by 6 in. long. and also is available in 7½-in. diam by 14 in. long.

AA Gage Co., 350 Fair St., Detroit 20, Mich. **T-9-1491**

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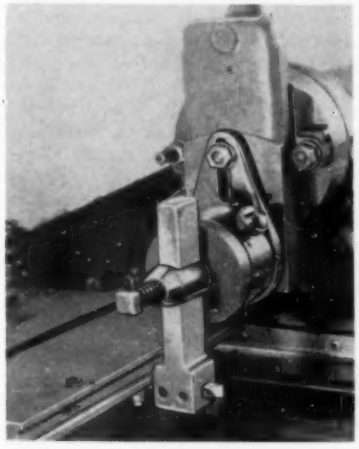
Tool Head

With the new Zierco tool head an operator of a shop shaper does not need to allow for tool relief on the backstroke when setting up work, because it provides automatic mechanical relief with the tool set in any position over a 360-deg range.

Consequently, such operations as internal die cutting, small hole internal



slotting, shaping T-slots or tongue and grooves, are easily accomplished, often in a single setting, of the piece worked. Tools are set quickly by an automatic locking device which involves an arrangement of radial indexes every 7½ deg. The head is secured by simply depressing a locking knob and releasing it after turning the tool and tool bar or post to the desired position.

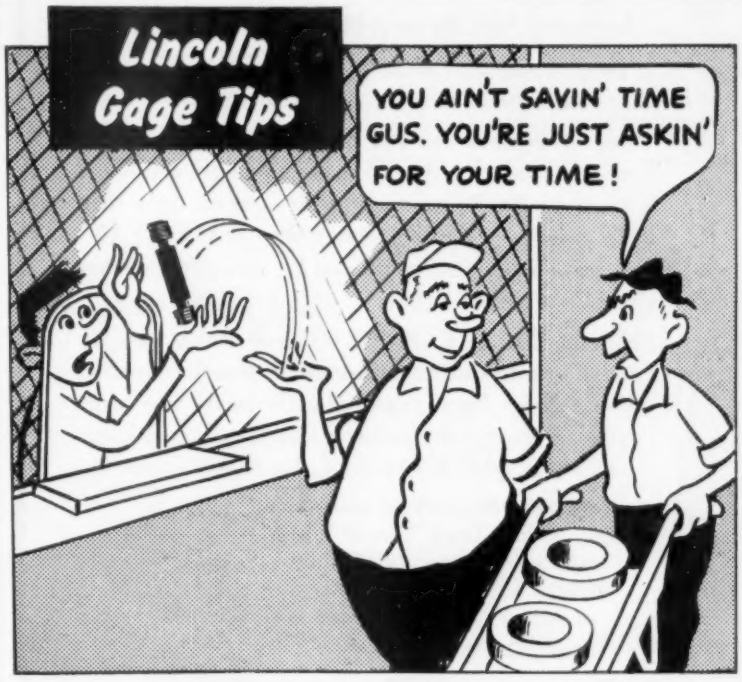
Reduction in resetting time is realized because complex shaping operations, which ordinarily require resetting the workpiece several times, can be made in one setting.

The tool head is available in three basic sizes, models B, C and D, to fit any size shaper from 12 in. up to the largest, as well as for light planers and planer-shapers. An internal bar and external tool post are included as standard equipment.

Zierden Mfg. Co., 3839 S. Kinnickinnic Ave., Milwaukee 7, Wis. **T-9-1492**

Forging Machine

Line of GFM forging machines is designed for rapid production, automatic control and high precision. Four forging hammers, equally spaced around the workpiece strike simultaneous blows 540 times per minute with a force of 132 tons or more. Work is chuck fed. Vertical movement and rotation of the chuck are automatically controlled and working position of the hammers is automatically adjusted so that up to 8 different cross sections can be forged on

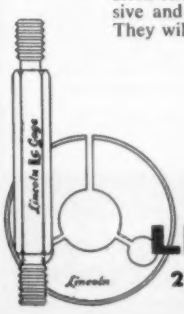


HANDLE A THREAD GAGE WITH CARE. Try not to bang it against another hard object or drop it. Such acts could nick the thread crest thus making the gage useless.

Some gages can be repaired only by grinding them under-size then bringing them up to size by Lincaloy chrome plating.

We, at Lincoln Gage, have developed this new plating process called Lincaloy. Ordinary plating processes have never given complete satisfaction. The chrome has chipped, peeled or distorted the thread form. Lincaloy eliminates these defects. A Lincaloy gage will give up to 400% more gage life and be extremely resistant to abrasion on production parts.

SAVE THOUSANDS OF DOLLARS! The Lincaloy process is not expensive and can be used on all gages. Send in your worn out gages. They will be returned better than new, at a much lower cost!



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"My WALES FABRICATOR didn't cost me a DIME"

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"Boy, oh boy . . . what this ten ton WALES beauty has done for me. Yes sir . . . it's really paid for itself.

"One of my jobs has 126 holes of various sizes and four corner notches. Used to take me hours and hours to set it up. NOW, my set-up time is never more than 29½ minutes complete, using the 'WALES-WAY' Sure, I'm making my profit and I'll soon need another WALES FABRICATOR."

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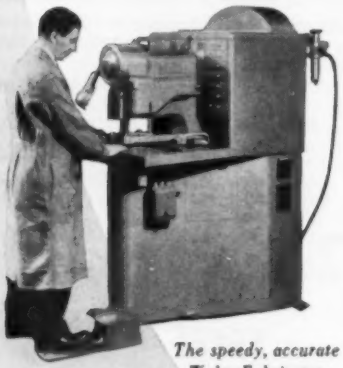

The speedy, accurate Wales Fabricator

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Describes the WALES FABRICATOR, with pictures and examples of work. Time studies are added proving the value of this money-saving equipment. CONVENIENT TIME PAYMENTS may be arranged.

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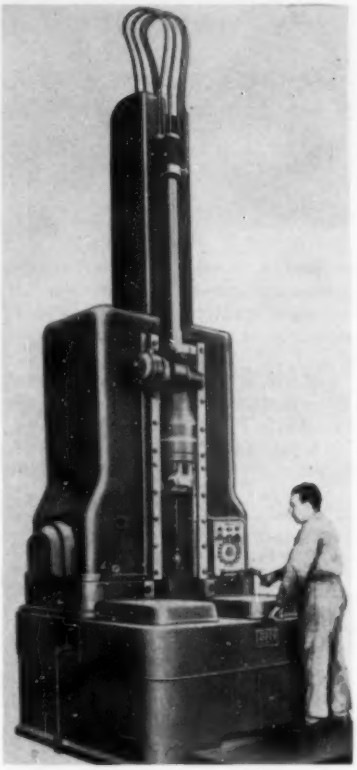


one piece in a single automatic operation. Outside dimensions are controlled by stop settings on index drums. Tapers and curvatures are regulated by template followers. Inside contours are formed around mechanically positioned mandrels. Work may be done hot or cold, on ferrous or nonferrous materials, on solid or tubular stock, with or without mandrel. Tolerances of 0.004 in. are possible in hot working, and up to 0.0004 in., cold. There are no vibrations.

Only a short setup time is required. Standard vertical machines will handle forgings up to 5 in. in diameter, 48 in. long. Larger work is usually done on horizontal machines having essentially the same features and capabilities. Tools are inexpensive.

Made by Gesellschaft fur Fertigungstechnik und Maschinenbau m.b.h., Steyr, Austria; distributed by Girard Associates, Chambersburg, Pa.

T-9-1501

Brazing Flux

Paste type flux for high temperature brazing of stainless and other high-alloy steels cleans and promotes wetting of the surfaces to be joined and helps dissolve oxides during the brazing action.

The material, known as Nicrobraz Flux, is a smooth, creamy paste that does not separate or crystallize. Where

a thinner consistency is required, it may be diluted with water. It has a melting point below 1200 F and is recommended for brazing applications involving temperatures between 1600 and 2200 F; within these limits, it will not boil or run off. Its cleaning properties enable it to remove oxides of chromium, aluminum and titanium from stainless steels.

Nicrobraz Flux may be applied by spreading, brushing, dipping or by any mechanized method. It can be applied either to base metal or to the brazing alloy rod, ribbon or wire. Brazing alloy in powder form may be mixed with the flux to form a paste.

Wall Colmonoy Corp., 19345 John R St., Detroit 3, Mich. **T-9-1511**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Roller Turner Toolholder

Disposable carbide inserts may be used with this roller turner toolholder. Cutting edges of precision ground inserts can be indexed to within 0.001 in. without resetting the holder. For easier initial setting a screw in the top of the

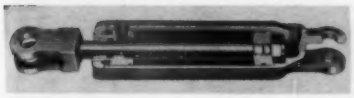
holder adjusts the cutting edge to the workpiece center line. The separate carbide chip breaker is adjusted in seconds after the holder is clamped in the roller turner. The holders made for all Warner and Swasey or Gisholt roller turners, can be used without chip breakers.

Wendt-Sonis Co., Hannibal, Mo.
T-9-1512

Heavy Duty Gland Cylinders

These heavy duty double and single acting cylinders employ a gland design and method of prestressing the snap ring within the cylinder which permits easy maintenance and assures rod alignment.

Piston rods are heavy chromed with aluminum alloy pistons to prevent corrosion and scoring. V-ring rod packings are independently adjustable. Bronze wiper ring on rods are used to prevent



foreign material from entering cylinders. Cylinders are honed seamless steel tubing with welded cast steel cleves. Design of the cleves prevents cylinder distortion during welding of the cylinder.

These heavy duty cylinders are available from 2½ in. through 4 in. bore and from 1 in. through 18-ft. stroke. They are designed for operation up to 1500 psi. Cylinders meet with A.S.A.E. standards for hydraulic cylinders.

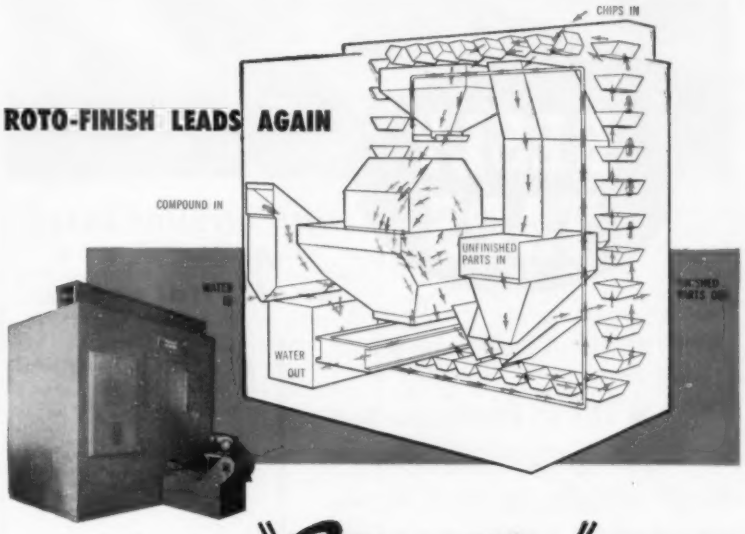
Densmore Engineering Co., Inc., 235 E. Greenleaf St., Compton, Calif.
T-9-1513

Small Parts Feeder

Automatic feeding of small production parts is done quickly and efficiently with this sliding action hopper feeder, called Hopperal. Using a gently oscillating motion, it causes a minimum tumbling of the parts.

The feeder selectively arranges small fasteners or parts on an internal track, permitting them to file in orderly manner to the outside feed track and down to any required position. A selector gate rejects pieces not properly positioned. Firmly supported by the hopper base, this track is rigid enough for lengthy extensions to the work operation.

Hopperal can be equipped with single or multiple tracks. It can be designed to feed two different parts from the same hopper, and to release a given number



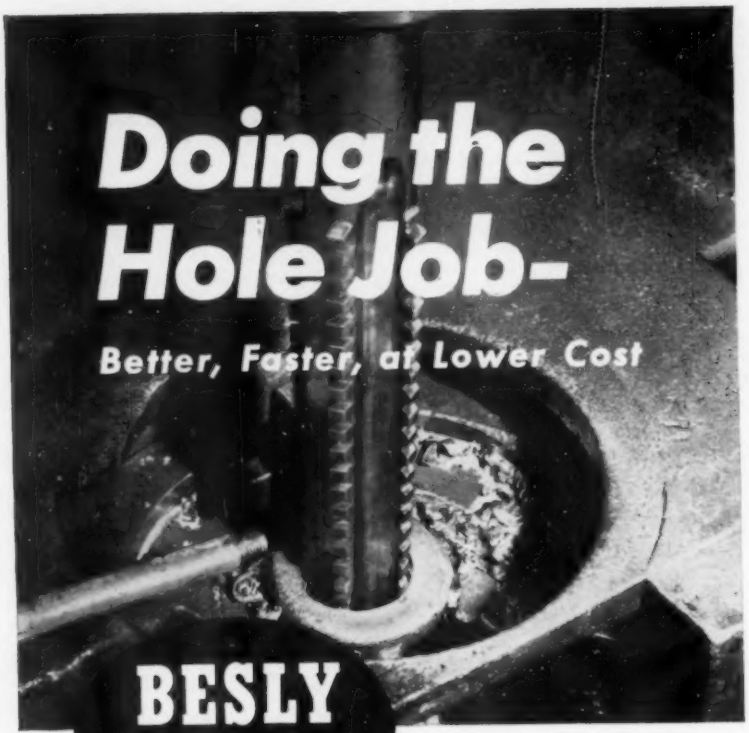
ROTO-FINISH LEADS AGAIN

the new "Rotomation" MACHINE

MAKES MECHANICAL TUMBLING A FULLY AUTOMATIC BARREL FINISHING PROCESS

- Completely Automatic
- Needs no operator in attendance
- Loads and unloads itself with each cycle.
- Cycle variable for different part requirements.
- Provides continuous operation
- Assures uniformity of finish
- Low cost operation — high production
- Complete package unit
- Simple to install . . . Electric, water, air and drain connections only.
- Suitable for straight line production.
- Thus, "Rotomation" barrel finishing machine becomes a machine tool.

Roto-Finish COMPANY
3746 MILHAM ROAD, KALAMAZOO, MICH.
P. O. Box 988 — Phone 3-5578
ORIGINATORS OF THE ROTO-FINISH PROCESS
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-151



BESLY TAPS with UNSURPASSED ACCURACY at all vital points

● LET US PROVE that Besly can help you get better threaded parts, longer tap life and lower tapping costs. Ask your authorized Besly Distributor for a TRIAL RUN on your toughest jobs . . . PLUS details on Besly's Super-Service on "Specials".

Tru-Square DRIVER

Mirror-Finish FLUTES

Solid Ground THREAD FORM

Accurate RAKE ANGLE

Microcentric CHAMFER

BESLY

BESLY-WELLES CORPORATION
Established as Charles H. Besly & Co. in 1875
118 Dearborn Avenue • South Beloit, Illinois

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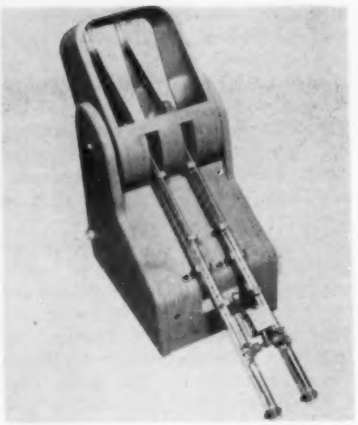

of pieces at a controlled rate of speed. It can serve to feed processing, assembly or packaging machines or other industrial requirements.

It may be adapted to standard machines or integrated with specialized ones. Self-powered, it becomes an independent assembly unit with addition of accessory components.

Haberstump-Harris, Inc., 10463 Northlawn Ave., Detroit 4, Mich. **T-9-1521**

Universal Air Fixture Lock

This universal air fixture lock, designed for instantaneous clamping on 6 separate applications, can be used on any machine.

Besides locking workpieces in position for work, the unit may be used to move one part of a fixture against another; to push workpieces into cutters; to load or eject workpieces automatically; press parts into a workpiece; or move parts of a machine.

Air cylinder of the fixture lock is machined to receive 5 interchangeable holding tools, which have ½-in. undercut adapter shanks and can be locked in place with a 5/32-in. socket set key. The cylinder can be mounted in any position, moved from job to job, and may be used with any of the five holding tools, or with specially made holding tools. Cylinders come in three sizes, with rated locking forces from 650 to 2300 psi, and power strokes from 1⅞ to 3⅛ in.

Wilton Tool Mfg. Co., Inc., Schiller Park, Ill. **T-9-1522**

Honing Unit

Improved design of combination pedestal Model JCP honing machine and coolant unit features enclosure of the coolant unit in the base, 10-gal capacity, large, expandable coolant tray working surface, and V-belt drive. Honing range of the machine is from

the ONLY
PORTABLE NIBBLER *that* CUTS

10 Gauge Steel

Model HN for 10 gauge Stainless Steel and 8 gauge Mild Steel. 6" radius.

Without Distortion!

A big statement . . . and only Fenway can make it! Our portable Nibblers have solved unusual problems for hundreds of users. Complete line includes the 14 gauge Nibbler and a light-duty 18 gauge Nibbler, and a special 90° head for each.

RCA—DU PONT—GENERAL MOTORS—and many others, use Fenway Portable Nibblers!

PAT. #2278174 #7278311 #2535631

Model MN for 14 gauge Stainless Steel and 13 gauge Mild Steel. 1" radius.

ALSO AVAILABLE: CORRUGATED, JIGSAW ASSEMBLY & AIR TOOLS

WIRE • PHONE • WRITE for complete information

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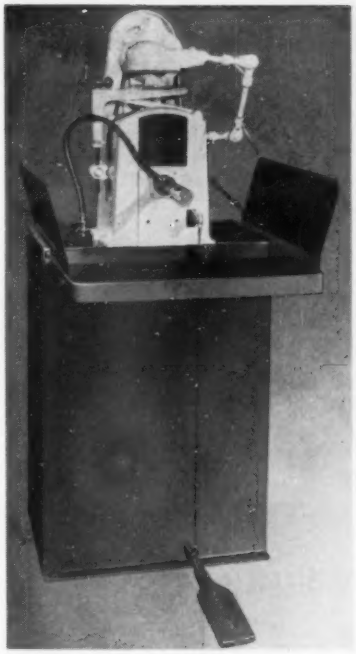
MACHINE COMPANY INC.
Edgemont & Clementine Sts.
Philadelphia 34, Penna.

Distributed by EASCO PRODUCTS

INDICATE A-9-153-1



0.120 to 2.500 without adapters.

Spindle speeds are adjustable from 400 to 1000 rpm without changing belts. Mandrels or stones can be changed without the use of tools. All mandrels fit the spindle with a bayonet lock.

The counterbalance foot pedal is adjustable to any desired pressure. The flexible coolant hose can be accurately aimed at any point, while the nozzle is adjustable to an oil flow most suitable to the needs of a specific job.

Superior Hone Corp., 1612 Elreno St., Elkhart, Ind. **T-9-1531**

Drilling and Tapping Unit

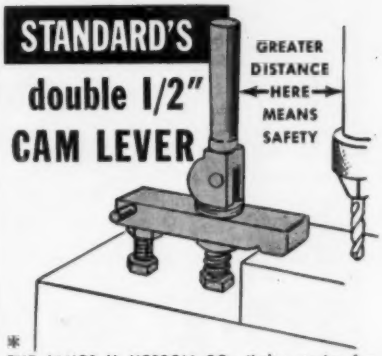
Instant change-over from drilling to tapping for long or short production runs is possible merely by flipping a switch without adding a special tapping attachment to this combination drill and tap unit called Series 28 Drill-N-Tap. Both drill and tap insert directly into the standard $\frac{3}{8}$ in. capacity chuck. Direct tool approach results in very little tool overhang, close mounting to the work fixture and low tooling cost resulting from the use of the same fixture to drill and tap.

Changing the direction of tool rotation for tapping is done electrically, and no clutches are used. With the control set for tapping, the direction of rotation automatically reverses at bottom of stroke to withdraw tap. Good, clean threads result from the two-way pneumatic system which makes it possible to infinitely adjust both the forward and

***CERTIFIED**
. . . up to 3,450 lbs. clamping force

STANDARD'S double 1/2" CAM LEVER

GREATER DISTANCE ←HERE→ MEANS SAFETY



*THE JAMES H. HERRON CO., (Laboratories for Testing, Analysis and Inspection) reports as follows: "With reference to the Double Cam Lever (500) and Eye-Bolt (500), we have conducted experiments to determine the amount of clamping force a man can exert with this device, lubricated. "Without the use of any auxiliary equipment, it was found that a man could exert up to 3,450 pounds, by bringing the lever to a position 90° with the Eye-Bolt."

Finger Tip Can Tighten Clamp.

Easy to Use—Positive Action

- Standard's Double Cam Lever offers maximum job clearance.
- Safe Operation—with handle *vertical* before clamping (as illustrated).
- Constant Maximum Clamping Pressure—perpendicular to center line of lever.
- Certified 6-Ton Back-Pressure Resistance—no danger of cam backing up.
- Ready to Use—no altering needed on assembly.
- No Lever Breakage—solid steel handle.
- This Cam can be applied to your Specially Designed Assemblies. Quotations on request.

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Standard Parts Company offers the most complete line of fine quality tool room standards available today. You can depend on Standard Components —they will never let you down.

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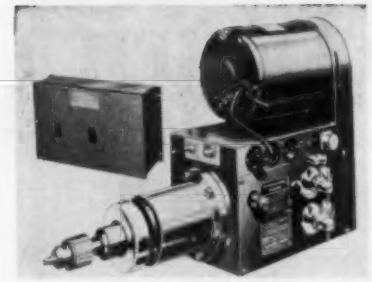
INDICATE A-9-153-2



retract air pressures and prevents tearing of top threads when pulling tap out of workpiece. Left-hand as well as standard drills and taps can be used.

Tool capacities for drilling are No. 60 to $\frac{3}{8}$ in. in mild steel; $\frac{1}{2}$ in. in cast iron, aluminum and brass. For tapping, they range from 2-56 up to $\frac{1}{2}$ in.—13 in 1020 steel; $\frac{1}{4}$ in. tapered pipe tap in steel; 2-56 up to $\frac{5}{8}$-13 in aluminum.

The Drill-N-Tap mounts simply and economically in a bracket that fits over the nose of the unit near the chuck. Mounting brackets bolt to any plane for operation in any position.

Complete interchangeability is possible where several units are being used as basic heads for rotation on a number of different setups. Units are quickly removable and can be inserted into another setup to immediately center themselves with the fixture. Electrical and pneumatic controls are built into the unit. Hydraulic feed control and electronic cycling for deep hole drilling are available as optional equipment.

The Dumore Co., Racine, Wis.

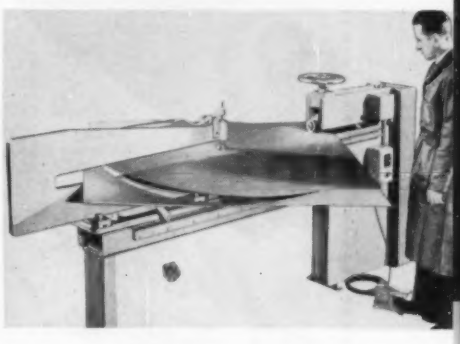
T-9-1541

Ring and Circle Shear

No. 31-RC ring and circle shear is designed with a self-compensating circle arm which floats on guided ways to maintain true center automatically.

With a scale provided for convenient setup, an adjustable crank permits quick positioning of the circle arm for cutting circles of various diameters. Quick-acting cam lever actuates the center clamp of the circle arm which is adjustable to hold varying thicknesses of material securely.

Straight line work, irregular outlines, circles, circular holes or rings may be cut with this shear. With a capacity of



10-ga mild steel, it cuts circles from 6 through 78 in. in diameter. A handwheel controls raising and lowering of the cutter, permitting the cutting operation to be started at any point on the blank.

High-carbon high-chrome steel cutters assure clean, fast cuts. Both an adjustable swinging gage for centering unmarked blanks and an adjustable straight slitting gage are furnished as standard equipment.

Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N.Y.

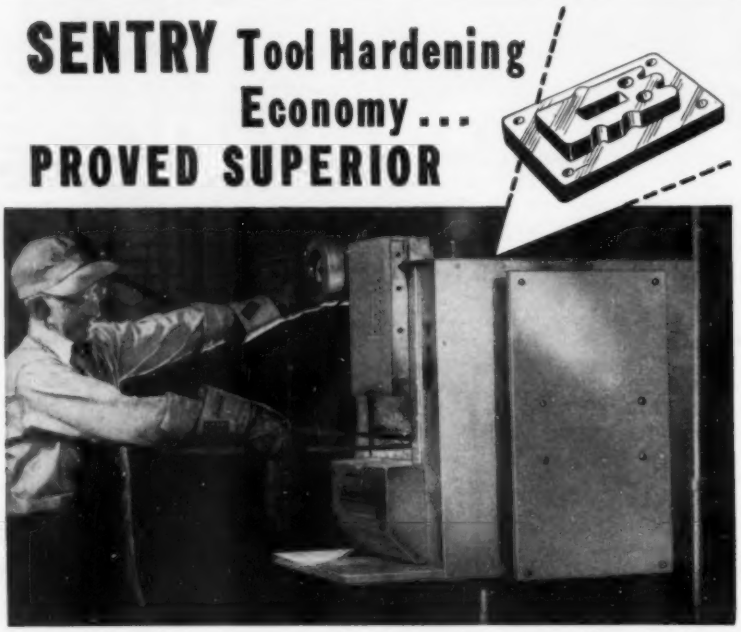
T-9-1542

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hydraulic Press

Electric magnetic controls are incorporated in this 575-ton hydraulic press to enable the operator to make adjustments of speed, timing and pressure from the main control panel. Cycle pattern can be changed to a new setup simply by resetting 6 control knobs on the main control panel; no cams are used to make these speed changes. Flexibility in cycle timing provides protection to expensive dies by permitting easy pressure to be applied at the time of contact and withdrawal. Because maximum speed can be maintained wherever

SENTRY Tool Hardening Economy... PROVED SUPERIOR



PERFORMANCE RECORDS from countless Sentry installations such as that illustrated here have shown conclusively that the Sentry Diamond Block method of heat treating high speed steel provides maximum economy.

The positive Diamond Block Atmosphere hardens all high speed and air hardening steels, including lower cost moly steels, consistently and without spoilage, true to size and completely free from scale or decarburization. For highest quality tool production use the proved superior economy of a Sentry Electric Furnace featuring the efficient Sentry Diamond Block Atmosphere. Consult Sentry for your own proof . . . demonstration hardening of your tools at no cost.

See us at Booth 1203 at the Cleveland Metal Show.

Request Catalog D-47 Write

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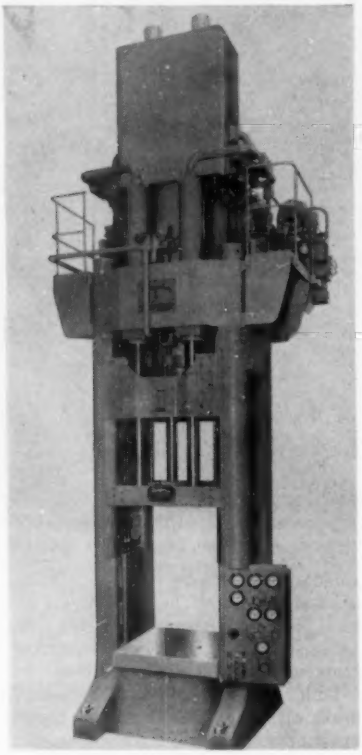


possible during a complete stroke of the press, over-all time is minimized.

With no danger of building up work-hardening stresses during the press stroke, it is possible to accurately draw-form difficult materials. This triple-acting press has four-point pressure adjustment of the blankholder—by turning four wheels on the control panel of the press, the exact pressure required at each point is applied.

A. B. Farquhar Div., The Oliver Corp., 108 N. Duke St., York, Pa. **T-9-1551**

Three-Dimensional Mill

Model 10RH milling machine, which will mill, jig-bore and duplicate in three dimensions has a hydraulic duplicator attachment for making duplicate molds and dies, or for contour milling to templates.

Movement of the table, knee and ram slide is controlled by the tracer head. As the operator moves the stylus over the master, the cutter duplicates his movements. Accurate reproduction of a metal, plastic or wood master is obtained by only 4 oz of stylus pressure.

A semiskilled worker can operate the machine efficiently. It can be used for experimental, prototype or production work, as a duplicator, or as a conventional mill.

Reversible ram turret has an all-angle

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-155

Why TECUMSEH Compressor Crankcases Are MICROHONED

"On Tecumseh compressors, we Microhone the piston bores. ***This gives us a running seal between pistons and bores which prevents gas leakage and eliminates the need for piston rings!*** Believe me, it takes a real combination of accuracy and functional surface finish to get results like that . . . and only Microhoning has given us that combination!"

(Tecumseh Products Company, Tecumseh, Michigan, is the world's largest producer of refrigeration compressors. Precision engineered and processed these units are hermetically sealed before leaving the factory.)

OTHER JOB DATA:

MATERIAL	Cast iron
PRECEDING OPERATION	Diamond finish-bore
MICROHONING OPERATIONS	One
STOCK REMOVAL	.0007" to .001"
FINISH	10 Microinches
TOLERANCES	
Diametric	.0003"
Roundness	.00015"
Straightness (Taper)	.00015"
HONING CYCLE	18 seconds, including fixture indexing time

"Here's our twin cylinder crankcase. The two piston bores in each case are opposite one another in the vertical plane, but they lie in two different horizontal planes. We simultaneously Microhone both bores in each crankcase, using a horizontal type machine with two opposing spindles."

"Although all of our crankcases are similar in design, the bores vary in diameter—1.312", 1.375", 1.500" and 1.625". Two fixtures on a two-position rotary indexing table let us Microhone one crankcase while another is being loaded. To run different bore diameters we just change the tools and gage rings. Switchover time is about five minutes."

Let a Micromatic Field Engineer show you how Microhoning will give you better functional finishes, closer tolerances and higher production.

☐ *Please have a Micromatic Field Engineer contact us.*

☐ *Please send literature and case histories on Microhoning.*

NAME_____

TITLE_____

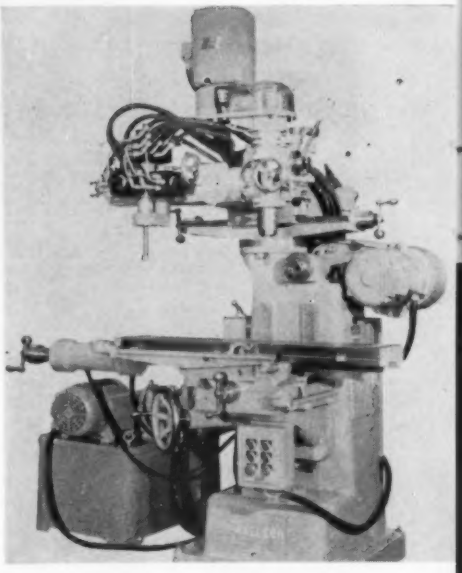
COMPANY_____

CITY_____ ZONE____ STATE_____

MICROMATIC HONE CORP.

8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-156



spindle head at one end and slotting head at the other. The entire turret rotates 360 deg to permit conversion from milling to slotting in a few seconds. Any compound angle is easily obtained.

Both the vertical and horizontal heads carry No. 30 NST spindle tapers to simplify tooling. The vertical spindle has speed changes from 75 to 6400 rpm at full 1½-hp torque. The horizontal spindle has a range from 55 to 3600 rpm at either 1 or 2 hp.

Axelson Mfg. Co., Div. of U. S. Industries, Inc., P.O. Box 58335, Los Angeles 58, Calif. **T-9-1561**

Adhesives

Industrial adhesives, protective coatings and sealers, adaptable to assembly operations, are capable of bonding a large variety of materials, resistant to temperature extremes ranging from −80 to +700 F.

Comprising both thermosetting and thermoplastic types of adhesive compounds, this line, called Ray-Bond, can be applied by almost any commonly used industrial method.

They are particularly suitable for use in industries ranging from aircraft manufacturing to building products where assembly line operations are used. They will bond, coat or seal wood, metal, plastics, glass, ceramics, friction material compounds, leather, paper, insulation materials, rubber, and cork.

Compounds are based on synthetic or natural rubber, resin bases of all types, and combinations of rubbers and resins which provide good performance under severe operating conditions.

In service, they offer excellent re-

sistance to most oils, solvents, gas and water.

Application techniques include use of spray, pressure flow systems, brush, roller coat and manual application. Methods of applying a specific adhesive and method of bonding can be varied according to requirements imposed by the product being fabricated.

Sealers and coatings in the Ray-Bond line involve special formulations tailored to specific applications.

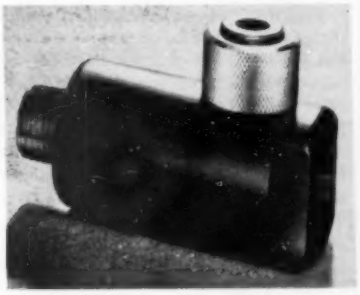
Special Products Dept., Raybestos-Manhattan, Inc., Bridgeport, Conn.

T-9-1571

Cutting Oil Aerator

This cutting oil aerator for installation directly into the feed line on production machine tools has through hole construction equal to nominal feed line pipe size. No filters or screens are used so there is no danger of flow impedance or clogging.

Air is introduced directly into the coolant from shop air lines, producing



tiny bubbles that cling to both tool and work and providing constant contact and conduction of heat and giving high cooling efficiency. The bubbles tend to lower specific gravity of the coolant, reducing splashing of the coolant and allowing it to cling to the work. A built-in regulator has fingertip adjustment controls for air feed into the coolant.

The aerator operates with any pump.

American Aerator Co., Paterson, N.J.

T-9-1572

Powder Metal Rolling Mill

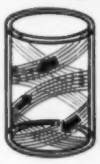
Model FH-400 powder metal rolling mill has 6-in. diameter x 6-in. face width chrome-vanadium alloy steel cold rolls, arranged horizontally, which turn on cage type needle roller bearings; end thrust is taken by radial ball bearings. Each roll neck bearing has a load capacity of 25,000 lb, equal to a maximum roll separating force capacity of 50,000 lb. Chrome-moly-tungsten al-

How MICROHONING Makes a Gas-Tight Running Seal Without Piston Rings

A leak-free, running seal between bores and pistons—without the use of rings—is possible only when the processing method generates diametric and geometric accuracy and the required functional surface finish. These characteristics are simultaneously obtained by the Microhoning process. Here's how:

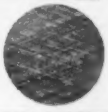
1 The sticks of abrasives in the tool form an abrasive "cylinder" and are fed out radially with equal pressure in all directions. High spots and tight areas in the bore are abraded first.

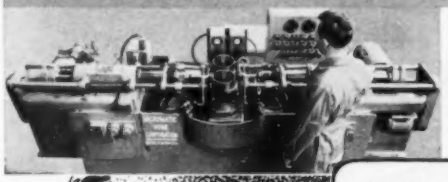
2 The long abrasive sticks cut only on the crests of wavy or snaky surfaces until the bore has the same diameter throughout its full length.



3 The combination of tool motion (rotation and reciprocation) and feed pressure fractures the abrasive grits that have become dull, and new sharp edges are formed; the clean constant cutting action of every stroke on the full bore length consistently generates the desired surface finish.

One of the exclusive advantages of Microhoning is its ability to produce whatever functional surface characteristics are required for maximum product performance. Microhoning's cross-hatch pattern, with its myriad of minute intersecting "valleys," furnishes an excellent surface for retention of lubrication.





"Here's one of two Micromatic Model 523-2 machines used on the compressor crankcase job. Tecumseh uses a total of 18 Microhoning machines on other vital processing operations."

The principles and applications of Microhoning are thoroughly explained in an informative 16mm., 30-minute sound movie, "Progress in Precision." We'll be glad to reserve a print for your use. Just tell us on the coupon the date you'd like to see it.

☐ Please send me "Progress in Precision" in time for showing on_____(date)

☐ Please send literature on Microhoning. I am interested in the following application:_____

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COMPANY_____

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MICROMATIC HONE CORP.

8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

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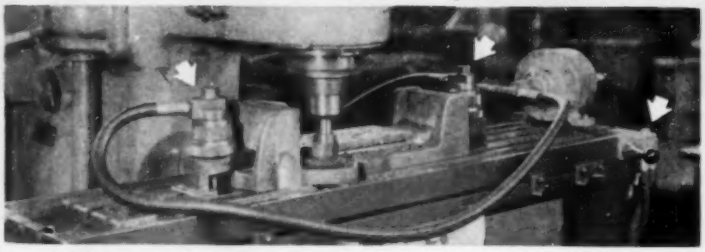
PowRlock gives this hand a 6000 lb. GRIP!



PowRlock AIR - HYDRAULIC CLAMPS provide instant automatic clamping on most existing machines and fixtures. Eliminate nuts, bolts, manual tightening, slash "reloading" time. Hydraulic pressure in the head activates a piston, which exerts up to 6000 lbs. locking force at one to 4 points. Comes complete with air-hydraulic system in 14 models. UNCONDITIONALLY GUARANTEED!

ATTACH THIS AD TO YOUR LETTERHEAD FOR FREE DEMONSTRATION OR LITERATURE.

WILTON TOOL MFG. CO., INC.

SCHILLER PARK, ILLINOIS

Sold By Leading Distributors The World Over

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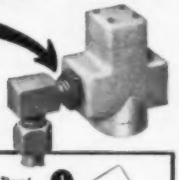
TRU-O-SEAL TEFLON SEAL

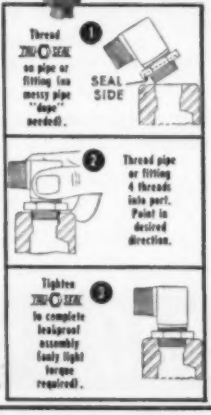
PAT. PENDING

STOPS PIPE THREAD LEAKS instantly!



Prevents future leaks!

TRU-O-SEAL does away with messy pipe "dope" compounds, eliminates damage caused by overtightening of conventional leaky joints, and is immune to ALL known hydraulic fluids and to steam, air, water, solvents, and practically all gases and chemicals. It withstands temperatures from —100° F. to plus 500° F., saves cost and labor of special or welded fittings, and has been fully field tested and proven by leading manufacturers. Comes in ⅛" to 2½" pipe thread sizes.


1
Thread TRU-O-SEAL on pipe or fitting (no messy pipe "dope" needed).
SEAL SIDE
2
Thread pipe or fitting 4 threads into port. Point in desired direction.
3
Tighten TRU-O-SEAL to complete leakproof assembly (only light torque required).

Write for data and prices

TRU-O-SEAL DIVISION
Flick-Reedy Corporation

2010 N. Hawthorne Melrose Park, Ill.

"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.

We Invite you to see Our Exhibit at

BOOTH #1623
METAL SHOW
Oct. 8-12

PUBLIC AUDITORIUM CLEVELAND

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-158-2

loy steel hot rolls may also be furnished for work at elevated temperatures. Such hot rolls may be fitted with cartridge elements to obtain internal heating. Cross sectional area of the four mill posts is 48 sq in.

Positive roll adjustment in either direction is made by means of a single handwheel. A graduated dial provides micrometer adjustment of the roll setting, and a clutch helps establish roll parallelism. Material passes from the rolls and through an independently installed sintering furnace. Stainless steel side guides control resulting strip widths.

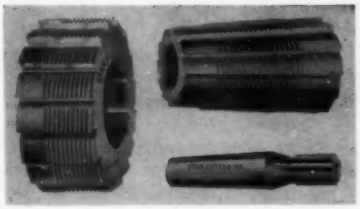
The unit is powered by a 5-hp, brake-equipped four-speed gearshift drive to operate at speeds of 10, 20, 30 or 40 rpm. Control is by forward and reversing magnetic starters with overload protection actuated by remote control push-button stations mounted on both sides of the mill base. Emergency stop panels are located on the front and rear of the machine.

Stanat Mfg. Co., Inc., 47-28 37th St., Long Island City 1, N. Y. **T-9-1581**

Multiple-Thread Milling Cutters

Accurate, long-life, low-cost, multiple-thread milling cutters are made from special high-speed forged blanks on which the teeth are formed with master form tools in a three-step production operation prior to a precision heat-treating operation. Because of the extreme precision maintained in the heat-treating operation, only the faces of the teeth and mounting surfaces need to be ground after heat treatment. Result is a tool with accurate, unground-form gear hot precision.

Star-Process accurate, unground-



form, multiple-thread cutters are made in both shank and shell-type designs to produce a variety of thread forms in accordance with customer specifications. They can be had with special thread forms as well as any of the standard straight, taper or pipe thread forms. Radial or hook grinds can be had as well as designs with straight or spiral gash.

Star Cutter Co., 34500 Grand River Ave., Farmington, Mich. **T-9-1591**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Grinding Wheel

Small diameter Grind-O-Flex, a flexible coated abrasive wheel for contour grinding and polishing measures 3 in. in diameter and 2 in. in width. The wheel is available in various grits from fine for polishing and buffing, to coarse for de-

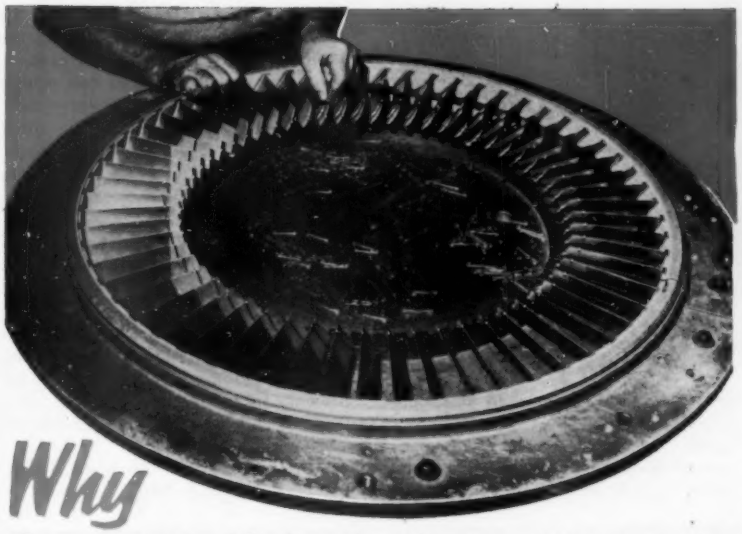
burring, smoothing flash and chamfering. It is used for sharp bends, contours of small radii and confined areas such as the inside of tubing. Simple to set up, Grind-O-Flex mounts on any spindle or chuck of present portable or stationary equipment.

Merit Products, Inc., 4023 Irving Pl., Culver City, Calif. **T-9-1592**

Horizontal Broaching Unit

Fixture locking, operation and unloading of this heavy-duty horizontal broaching machine are fully automatic. Loading also can be done automatically when required.

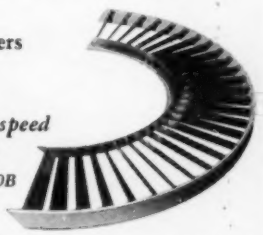
Frame is of all-welded, heavy steel plate construction, while an oversize bull gear provides positive pulling power, extra weight and smooth opera-

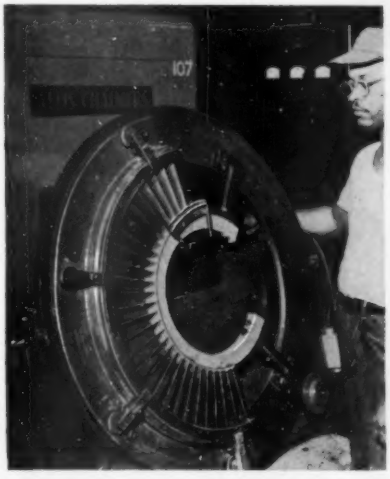


Why these stator blades for Curtiss-Wright J65 jet engines are brazed with EASY-FLO*

Allis Chalmers does this job with EASY-FLO for the same reasons that a great many manufacturers use this low-temperature silver brazing alloy — namely — the *great strength* and *virtual indestructibility* of EASY-FLO joints – plus the *speed* and *economy* with which they can be produced.

*EASY-FLO meets SAE Aeronautic Materials Spec. AMS 4770B





THEY USE THE EASY-FLO FAST BRAZING FORMULA

PREPLACING the alloy – plus a setup that speeds handling and heating – that's the formula. Top picture shows parts being assembled in circular fixture with clips of EASY-FLO wire being preplaced over blade ends. At left – as half of fixture rotates, inner end of shroud passes through induction heating coil section at top. Time cycle for completing a half (28 joints) is 10 minutes. Blades are *nickel steel* and shroud ring is *brass*. EASY-FLO is particularly effective in joining dissimilar metals. Average strength of joints is *double* the specified minimum pull of 2800 lbs.

GET FULL EASY-FLO FACTS AND DISTRIBUTOR LIST

BULLETIN 20 explains why high-strength, speed and economy are inherent in EASY-FLO brazing. Also gives useful information about joint design and fast brazing methods. A copy, with Distributor List, will be sent at your request. Write today.

HANDY & HARMAN

General Offices: 82 Fulton St., New York 38, N. Y.

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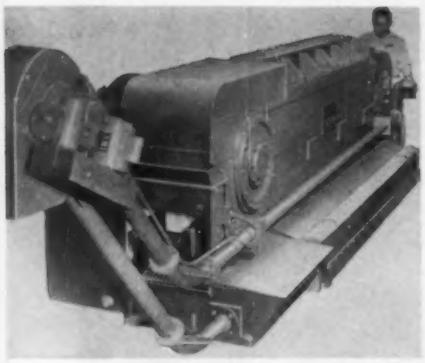
MONTREAL, CANADA

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-159



tion. Easy, safe loading and unloading of a broad variety of work sizes and shapes is possible because of extra fixture clearance formed by the large radius from the chain axis to the outer machine frame. A safety interlock device prevents operation until parts are positively positioned in the fixtures.

Cutting speeds up to 40 fpm can be obtained from the heavy-duty twin-chain electric-mechanical drive. Other speeds can be obtained through simple change gears. Fixtures are the hammer lock type, automatically located, locked, opened and emptied.

The machine is self-contained, including the filtered coolant tank, pumps and endless conveyor automatic chip disposal unit. All electric and hydraulic equipment conforms to JIC standards. Model illustrated has 90-in. stroke with 15-ton capacity, and is approximately 60 in. high by 70 in. wide by 207 in. long, plus chip conveyor overhang.

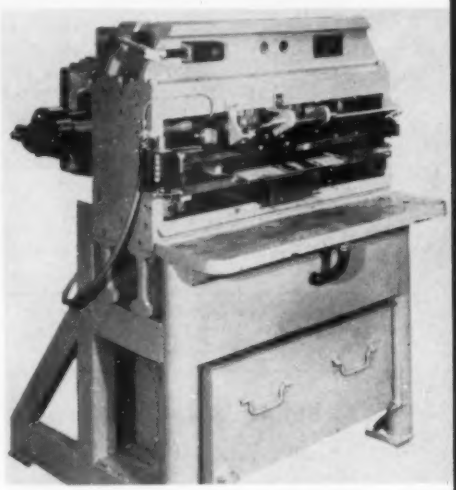
Detroit Broach Co., Rochester, Mich.

T-9-1601

Shaft Knurling Machine

Used in installing the spline type knurl on small electric motor shafts, this shaft knurling machine will produce a knurl up to 3 in. long on shafts up to 20 in. long, and up to 5/8 in. in diameter.

Shafts are hand-fed down a magazine, and automatically roll out into a receiving tray after being knurled. Rate of production is approximately 3000 shafts per hour. The knurl is installed in a consistently square and uniform manner. A coolant system is built into the machine.



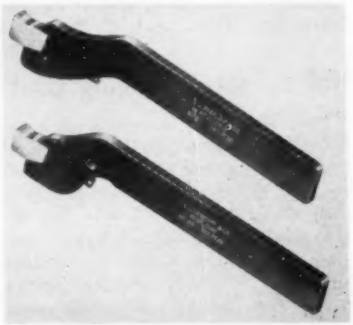
Morley Machinery Corp., 1239 University Ave., Rochester 7, N. Y.

T-9-1602

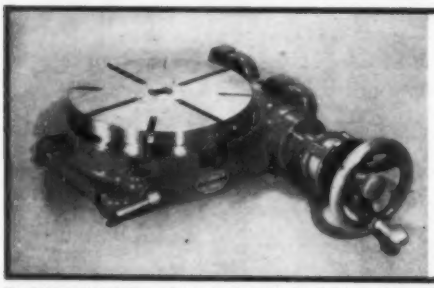
Plunge and Form Cutting Tools

High performance and economy are gained through these gooseneck and spring toolholders with interchangeable high-speed steel metal-cutting inserts developed for plunge and form cutting.

Developed for use on planers, shapers and lathes, the tools provide a resilient arch, while pulling instead of pushing



For angular spacing jobs so precise you could never handle them before



A Rotary Table accurate to ± 3 sec. in 360°
(USING CHART)

No. 2 Moore 11-Inch Rotary Table, *developed by the builder of the Jig Borer and Jig Grinder.*

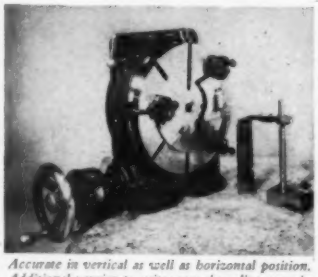
THE FOLLOWING ACCURACY BUILT FOR SHOP USE:
All points in 90° increments, from zero, ± 1½ sec.
All points in 18° increments, from zero, ± 2 sec.
All points in 2° increments, from zero, ± 4 sec.
Worm accuracy, ± 1 sec.
Repetition of settings, ± 1 sec.
4 sec. = .0001" on 10" dia.

How many jobs have slipped by you because the angular spacing requirements were just too much for your equipment?

With Moore's new 11-Inch Rotary Table, you can easily handle the most precise angular measurements. Having an overall performance accuracy of ± 6 seconds throughout the entire 360°, this table is already being used successfully by several leading companies on government-sponsored precision jobs never before accomplished.

This extreme accuracy is achieved by a non-disengagable, thread-ground worm, combined with accurately spaced teeth of its mating gear. An ultra-sensitive method of angular measurement—interferometric inspection and calibration—used industrially for the first time, assures tooth spacing accuracy within less than ± 4 seconds.

You can use this rotary table for countless precision spacing applications on jig borers and jig grinders. Examples: Spacing holes in a circle on either machine; set at right angle for additional machining and inspection jobs; with its companion unit, the new No. 2 Sine Plate, to produce compound angle settings. Write today for Bulletin RT2.



Accurate in vertical as well as horizontal position. Additional vernier permits normal reading even in vertical position.

Accuracy assured by interferometric inspection and calibration. This is the first time industry has used light-wave measuring methods for precise division of the circle.

MOORE SPECIAL TOOL COMPANY, INC.
732 Union Avenue, Bridgeport 7, Connecticut

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

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cutting action permits deep slots ¼ in. wider than the thickness of the tool to be cut without chattering or danger of digging into the work.

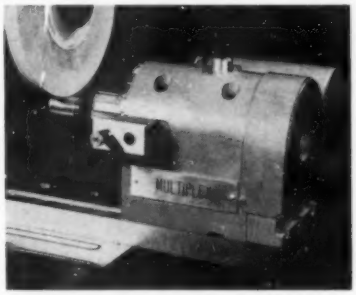
The tools are used for flat finishing large surface areas using from ½ to ¾-in. feeds; for plunge cutting deep slots; roughing and finishing deep channels and recessed areas; for down side cutting to the full width of the insert. Radius, angle, or any contour can be formed simply by installing an insert of the proper shape.

B. J. Traycoff & Co., 509 Carthage Ave., Kent, Ohio. **T-9-1611**

Indexing Head

With this motor driven multiplex rotary head, designed also for manual indexing, work can be positioned on a grinding machine table and rotated by motor drive. Workpieces also can be indexed manually for milling, drilling and boring operations.

The head is equipped with collets ranging from ¼ to 1 in., and with an



interchangeable 4-in. three-jaw chuck. A 24-step plate and stop pin are employed for the index positioning. The motor rotates the spindle at approximately 250 rpm. Motor and spindle are assembled on a common base for either vertical or horizontal application. The motor is belt connected.

Multiplex Co., 1536 Getty St., Muskegon, Mich. **T-9-1612**

Engine Driven Welder

Battery start and direct coupling between engine and generator are incorporated in the design of this engine driven welder, available in 300 and 400-amp models. Constructed of extra heavy steel, the welder has no projecting generator or controls.

Maintenance is simplified. Constant pressure brush springs require no adjustment and sealed bearing on generator requires no lubrication. There is no need for an exciter.

Gasoline driven models are equipped

HAVE YOU HEARD ABOUT THIS EXTRAORDINARY CLEANER?

It saves money in paint shops!

Oakite Rustripper is an alkaline material that strips paint, pigment residues and phosphate coatings from steel at the same time that it removes rust and oil.

It saves money in plating shops!

Oakite Rustripper removes rust or heat scale from steel at the same time that it removes oil and other soils. It avoids hydrogen embrittlement, damage to machined surfaces and other disadvantages of acid pickling.

FREE

For more information about how Oakite Rustripper eliminates operations in paint shop and plating shops, send for one or both of the illustrated booklets listed in the coupon.

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new! ALINA
DRILL GRINDER
set-up and sharpen
small drills
in 30 seconds

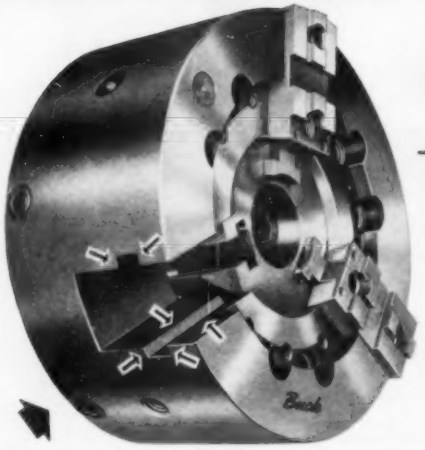
ALINA

- Sharpens drills from .012" to .250" with only two chucks
- No skill required
- One quick adjustment for right or left hand drills
- Concentric accuracy of sharpened drills guaranteed to .0004"
- No resetting of unit for grinding different diameters or types of drills

For name of nearest representative write:
ALINA CORPORATION
401 Broadway, New York 13, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-162-1

Get Into Production Quicker On Every Job



Buck
AJUST-TRU®
AIR CHUCKS

You can save from several minutes to many hours on every set-up for your chucking machines with the Buck Ajust-Tru power chuck.

Jaws can be machined in the tool room—and hardened if you wish—since there is no need for extra machining to fit jaws to the work. Final accuracy adjustments are made by the chuck . . . *in a matter of minutes* . . . holding work under full air pressure!

Jobs can be run intermittently *without re-truing jaws.* On new runs and re-runs accuracy within .001" is guaranteed. Write for full details today.

Hardened Key Ways Standard Feature

Hardened key ways of the Buck, combined with hardened jaws, let you run thousands more pieces (holding tolerances within .001") than conventional chucks.

Buck Air Chucks are made in 6", 8", 10", 12" diameters—2 or 3 jaws. NO PRICE PREMIUM.

BUCK TOOL COMPANY
933 SCHIPPERS LANE • KALAMAZOO, MICH.

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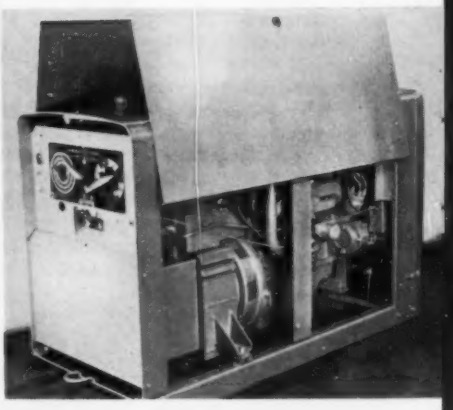


with Hercules JX4 engines, rated 54 hp at 2150 rpm. Both models have a duty-cycle of 60 percent, rated temperature rise of 50 C, open circuit voltage of 80, and operate at maximum rpm of 2150.

The smaller unit, designated 30AG, has a welding range of 60 to 375 amp, and electrode capacity of 3/32 to 5/16. The larger unit, 40AG, has an operating range of 80 to 500 amp, and electrode capacity of 1/8 to 3/8.

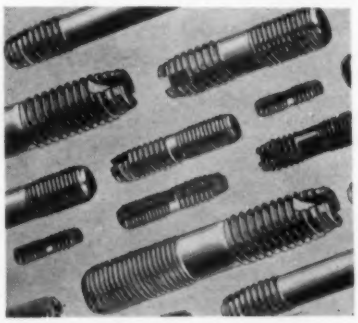
Both 2 and 4-wheel trailers are available to meet varying requirements. The two-wheel trailer features a small, retractable 12 in. diam wheel on tow-bar to simplify handling.

Welding Dept., General Electric Co., Schenectady 5, N. Y. **T-9-1621**

Self-Tapping Studs

This double-ended stud cuts its own thread when driven in an ordinary drilled hole and locks securely in the same operation. Tapping, driving and locking are completed in one fast operation. Hole tolerance is not critical, and no special hole preparation is needed.

The parts, called Schweppe studs, can be installed at high speed with any power stud driver without special adapters or attachments. They also can be removed from the hole without thread damage and then redriven in any drilled or tapped hole of the same size. They can replace standard studs in existing



tapped holes. They can be located accurately from the slotted end to permit automatic hopper feeding and driving of studs.

The studs are made with hard rolled threads in any desired styles at each end. At one end, a double thread-cutting slot is milled in from opposite sides at an angle toward the end of the stud. Depth of the slot is the same as the ASA standard screw slot depth, permitting accurate location for automatic feeding and driving.

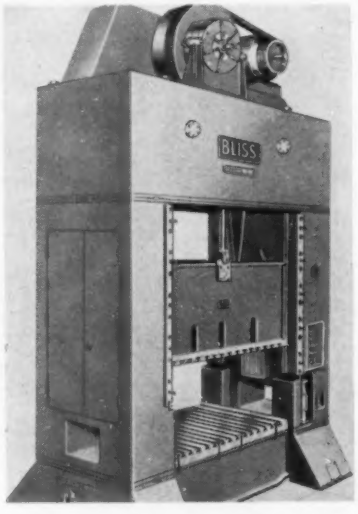
Slots are located on opposing radii to provide a positive rake angle on the cutting edges. They can be driven in steels, cast irons, aluminum, magnesium and plastics. They are supplied in any required length, and any diameter from No. 4 through 1 in.

Pheoll Mfg. Co., 5720 Roosevelt Rd., Chicago 50, Ill. **T-9-1631**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Basic Press Unit

Line of single action, eccentric geared, two point presses is designed to provide users with a basic machine which can be built up by adding various units to fit individual press needs. All presses in the SE-2 line are available in

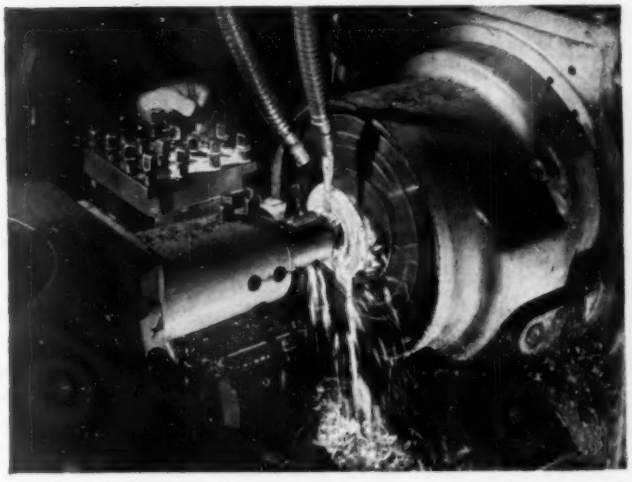


a full range of tonnages in both double and single geared models, with no inbuilding or extras unless specified.

Of all welded construction, the units have a 4-piece frame and tie rods drilled for electrical shrinking. Special features that can be added, in whole or part, to the basic unit include: provision for automatic controls and feeds, inbuilding, various types of automatic lubrication, air and electrical outlets for

Improved Lusol..

A BETTER PRODUCTION METHOD



Improved Lusol, an oil-free transparent water-soluble metalworking solution, has the highest heat removing capacity of all coolants, regardless of type. It keeps tools cooler so cutting edges last longer. It keeps work pieces cooler so closer tolerances can be maintained. In addition, the Lusol method keeps machines clean, eliminates odors, smoke and oily floors, and eliminates the basic causes of dermatitis. It all adds up to better production under better working conditions. That is worth investigating.

CONCENTRATION TEST KIT

With this pocket size Concentration Test Kit Lusol users can check the concentration of the solution right at the machine. Only takes a minute or two.

THE Lusol.. LINE
BETTER PRODUCTS FOR BETTER METALWORKING

F. E. ANDERSON OIL COMPANY INC.
BOX 213, PORTLAND, CONNECTICUT

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. . . and you can change your method of cylindrical grinding to obtain MICRO-FINISH with POSITIVE ROUNDNESS!

The RED-E new grinding concept is so graphically an improvement over conventional methods that even the 'die-hards' are changing over. Old-timers throughout the country have convincing proof that chatter, wheel-marks, out-of-roundness and costly secondary operations can be eliminated and controlled . . . that roundness is only as accurate as the Center hole alignment. With RED-E they now achieve super-finishes in cylindrical grinding!

Send for the new RED-E Concept Booklet! It explains how you can obtain the ultimate in grinding accuracies to within less than 50 millionths (0.000050") t.i.r.

Mail Coupon Today

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Gentlemen:
Please rush ( ) copies of your Concept Booklet.
☐ May we have your new Center Catalog, too, please?

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maintenance tools, die lights, air control manifolds, and special controls.

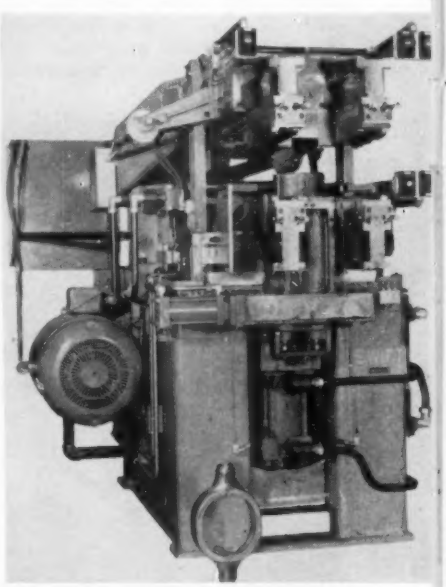
A further feature is the "unitized" principle used in construction. A quill-mounted flywheel and overhung clutch are built into a unitized gear case on which the main motor drive is mounted. Except for the main gears, nothing is built into the crown. The entire drive can be removed from the press as a unit, and reinstalled, with minimum time and effort.

Belts can be replaced after removing only the brake pins, while the entire clutch can be taken off by simply removing the brake bracket. By removing only 6 screws, the quill assembly including the clutch can be taken out of the gear case.

E. W. Bliss Co., 50 Church St., New York 7, N. Y. **T-9-1641**

Flash Trimmer

This hydraulically operated flash trimmer employs broaching for fast, economical high-production removal of excess metal. The unit is particularly adaptable to parts requiring machining after welding. It will trim a number of faces



in various planes. The broaching is a draw-cut operation.

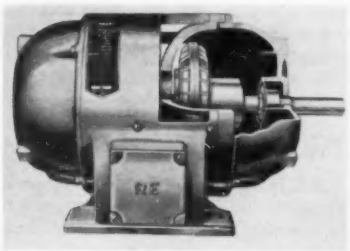
All machine operations, including clamping, broaching and trimming, are powered by a rotary-vane hydraulic pump. Hydraulic equipment is mounted on the sides of the unit, readily accessible for maintenance. Both broaches and rotary cutters are easy to adjust and replace.

Swift Electric Welder Co., 8095 Livernois, Detroit 4, Mich. **T-9-1642**

Dry Fluid Motor

A fluid-drive principle that utilizes steel shot instead of a true fluid is provided by this Flexi-Shaft motor. The coupling is mounted inside the motor's frame and the entire unit is supplied as a single-frame power package.

This "dry-fluid" line is available in many combinations with magnetic brakes and gear reducers to solve



special drive problems. Features of the motors include smooth load acceleration, protection against equipment jamming, and the ability to start heavy loads on lower, actual operating horsepower.

The dry-fluid coupling is an adaptation of the Dodge Flexidyne drive, based on centrifugal force throwing the steel shot to the perimeter of the housing. The housing is keyed to the load and accelerates as the rotor gradually becomes imbedded in the tightly packed shot.

Flexi-Shaft motors are produced in ratings from ½ through 15 hp.

Reuland Electric Co., Alhambra, Calif. or Howell, Mich. **T-9-1651**

Straightedge Counterbalance

A straightedge counterbalance for use wherever straightedges are used on a steeply inclined surface or on a vertical board, is designed with an adjustable weight factor that permits the counterbalance to be adjusted to the weight of any straightedge.

It can be used with any of the several styles of straightedges using the under board type attachment.

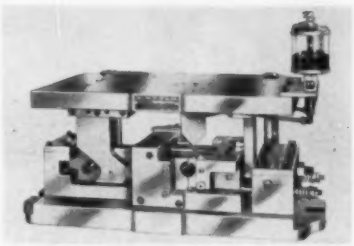
Installation to the edge of the table top is simple. The rod of the counterbalance comes in a standard length of 44 in.

Mayline Co., 619 N. Commerce St., Sheboygan, Wis. **T-9-1652**

Tube Cutoff Tool

Fast, clean, economical shearing pipe and tubing is accomplished with this new cutoff unit. In a single downstroke of the punch press, it will shear off pipe or tubing in accurate lengths of ½ in. or more to within ± 0.010 in. Edges of both sheared pieces will show only a trace of roughness or burr.

Costs run about ½¢ per cut. Depending on length and wall thickness, approximately 1000 to 2000 pieces of pipe or tubing can be easily handled per hour.



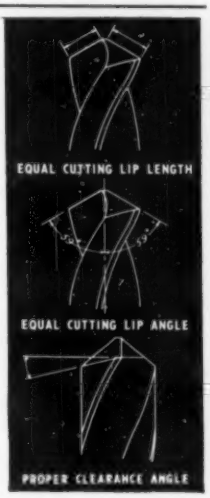
Blade in the tool can make 10,000 to 15,000 cuts, and the die 25,000 to 35,000 cuts, before they have to be resharpened; both the blade and die are easily removed and replaced. All blades and blocks are interchangeable and are

NO GUESSWORK!
NO COMPLICATED SETUPS!

WITH GRAND RAPIDS DRILL GRINDERS

BY Hammond OF KALAMAZOO

— save time and money . . . conserve skilled labor . . . keep your twist drills factory sharp . . . produce perfect points automatically . . . with the well known GRAND RAPIDS double-end drill grinders. The only adjustment (made in seconds) is that of tailstock to accommodate length of the drill. GRAND RAPIDS drill grinders have proved themselves in thousands of leading plants the world over.



GRAND RAPIDS
TAP GRINDERS

For perfectly ground taps assuring clean, sharp, accurate threads use a GRAND RAPIDS combination drill and tap grinder, or a single-purpose tap grinder. GRAND RAPIDS tap grinders set the standard for fast, foolproof, correct tap grinding.

Hammond Machinery Builders INC.

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1661 DOUGLAS AVE., KALAMAZOO, MICH.

See us at Booth No. 1250 Metal Show, Cleveland—October 8-12.
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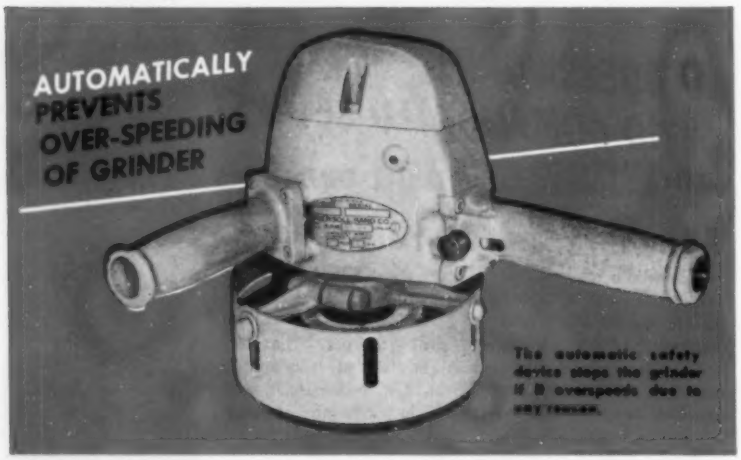
NEW

THE ONLY

SURFACE GRINDER with a POSITIVE SAFETY SHUT-OFF!



PLUS THESE OTHER COST-SAVING OPERATING ADVANTAGES:

- Handles can be set at 90° or 120° for close corner work and operator comfort . . . another Ingersoll-Rand FIRST!
- A responsive governor insures maximum cutting speed and minimum air consumption regardless of load.
- Single point lubrication, double-sealed wheel bearings, large oil reservoir for long life, low cost operation.
- Top of tool is flat for easy pressure application.
- Available in 2 Models and 4 speeds as follows:

  Speeds: 3100—4100—4500—and 6000 rpm.

  Size 41F with push-locking throttle for constant operation.

  Size 41FX with self-closing, safety type throttle.

Ask for a demonstration of this new safety grinder in your shop.

8-343

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-166

obtainable in any size or diameter within the range of the tool. The cutoff can readily be removed, allowing the punch press to be used for other jobs.

The cutoff is available in 3 standard sizes to accommodate tubing up to and including ½-in. OD x 3/32-in. wall, up to and including 2-in. OD x ⅛-in. wall and up to and including 3-in. OD x 3/16-in. wall.

Vogel Tool and Die Corp., 1825-7 N. 32nd Ave., Melrose Park, Ill. **T-9-1661**

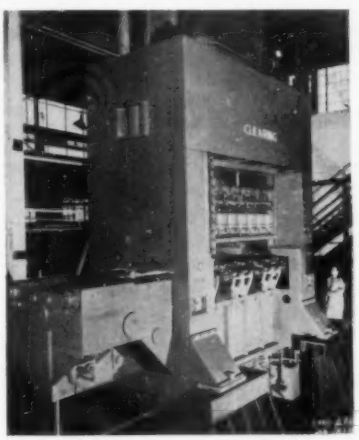
USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Transfer Press

Multiple-purpose automatic presses, identified as Transflex, are designed to be used to produce a variety of different parts and to be changed over from one job to another quickly and easily. They are particularly useful in job stamping shops, where requirements for diversified production take advantage of this flexibility.

In these presses features that need to be changed when different parts are run are designed to be adjustable.

The automatic feed that carries the piecepart through the press has been



designed so that the feed stroke is adjustable. A Transflex feed may be indexed any distance required by the number and size of dies used. Simple adjustments are provided so that feed fingers can be quickly respaced along the feed bar to accommodate varying feed lengths. Fingers also may be easily changed to grip parts of different dimensions.

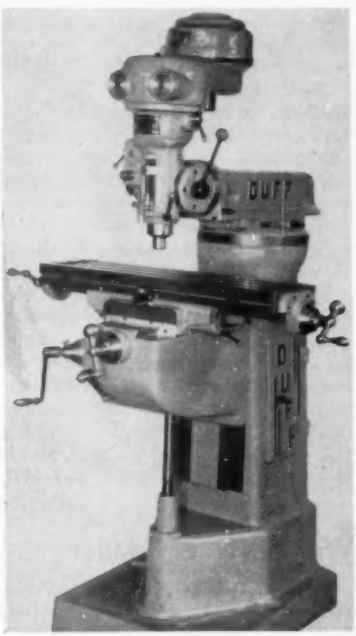
Die cushions are mounted on a track within the press bed so they can be moved laterally by an adjustment mechanism outside the bed, to wherever blank-holding pressure is most needed.

Presses have adjustable knockout positions, and air cylinders eject the part when the slide is raised. Positive mechanical knockout is also provided in the event a part becomes so firmly seated in the dies that the cylinder remains compressed. Both cylinders and rods are adjustable left and right.

Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill. **T-9-1671**

Milling Unit

Model VS-4 1-hp milling attachment on this ram turret vertical miller has variable spindle speeds from 85 to 3000 rpm. It is fully universal, rotates 360



deg around face of ram and 45 deg in or out across table.

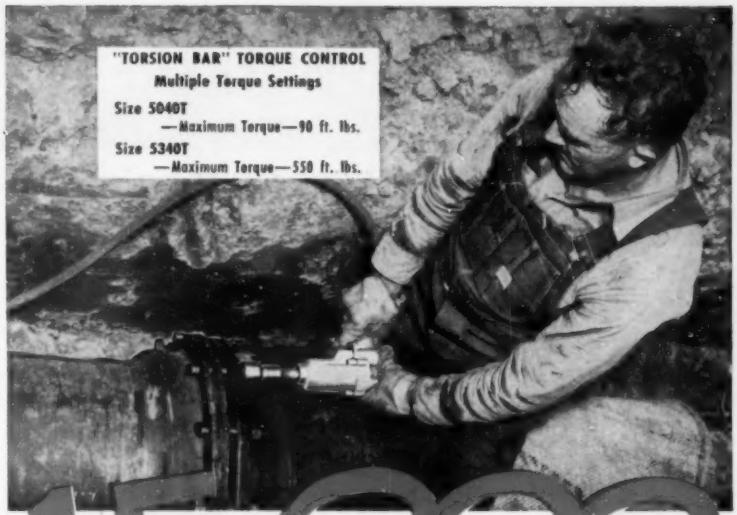
When operating the unit, the operator only engages or disengages back gears and dials the speed suitable for the job.

Duff Machine Co., 31 Wingate St., Haverhill, Mass. **T-9-1672**

Heat Treating Furnace

A furnace has been designed for critical temperature heat-treating operations such as annealing large intricate assemblies of laboratory glass, production heat-treating metal, etc.

The interior dimensions of this furnace are 24 in. wide x 24 in. high from hearth to roof and 72 in. long. Temperature evenness is easily attained while different parts of the furnace are easily controlled and indicated by means of



15,000

3/4" bolts uniformly tightened to 60 ft. lbs.

TORSION BAR with new Ingersoll-Rand

Torque Control IMPACTOOL

PROBLEM:	Assembly of 1390 mechanical pipe joints involved over 15,000 3/4" bolts. The problem was to speed assembly, remove guesswork and assure proper tightness of all joints.
AIR ENGINEERING SOLUTION:	A new Ingersoll-Rand Size 5040T Torsion Bar Torque Control Impactool, preset to deliver 60 ft. lbs., was put on the job.
RESULT:	The Torque Control Impactool automatically shut off at the preset Torque . all guesswork was eliminated . . uniform joint tightness was produced . . . an average of 10 minutes per joint was saved . . . smaller bell holes were required due to compact size of the 5040T . . this one tool produced an extra profit of $404.25 on this job.

You can put these new "Torsion Bar" Torque Control Impactools on your nut running jobs and reap these benefits: Positive Torque Control . . . Simple Torque Setting . . . Setting remains constant . . . No pressure regulators needed . . . No operator training.

Write or phone for a free demonstration of this revolutionary fastening development.

Ingersoll-Rand

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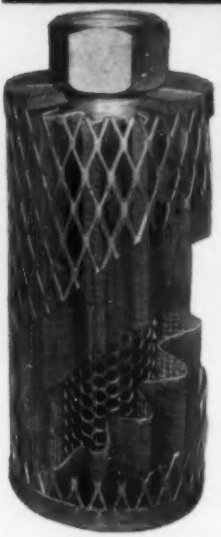
MARVEL Synclinal FILTERS



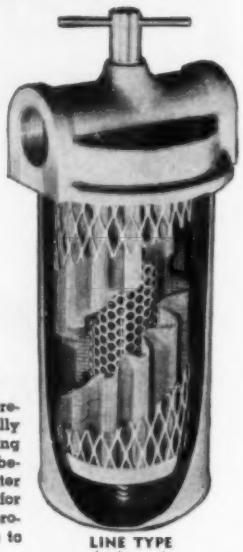
SUMP TYPE
(cutaway)

For Efficient Filtration of--

Hydraulic Oils –
Fire Resistant Hydraulic Fluids –
Coolants – Lubricants –
Water

OVER 700
Original Equipment Manufacturers Synclinal Filters Install Marvel as Standard Equipment

Meet J.I.C. Standards



LINE TYPE
(cutaway)

PROTECT EQUIPMENT
INCREASE PRODUCTION
REDUCE MAINTENANCE

Marvel Synclinal Filters installed in the sump or on the line preceding pump offer maximum protection on all hydraulically actuated and other equipment utilizing low pressure circulating oil systems. Maintenance and production costs are reduced because Marvel Synclinal Filters BALANCED design offers greater ACTIVE filtering area with sufficient storage capacity for filtered out damaging particles, thus, longer periods of productive operation are attained at minimum "down time" due to maintenance and repairs.

PRODUCTION ENGINEERS and MAINTENANCE MEN whose job it is to keep production machinery operating at peak efficiency and who have recognized the superiority of Marvel Synclinal Filters in the filtration of hydraulic oils, fire resistant hydraulic fluids, coolants, lubricants, etc. are specifying Marvel Synclinal Filters on all new equipment and standardizing with Marvel Synclinal Filters on all machines within their plants.

Another outstanding reason for their preference is the simple construction of Marvel Synclinal Filters which allows them to be easily disassembled, thoroughly cleaned and reassembled on the spot, by any workman in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of Monel mesh sizes range from coarse 30 to fine 200.

IMMEDIATE DELIVERY

As in the past, Marvel continues to offer Immediate Delivery!

MARVEL ENGINEERING COMPANY

7227 N. Hamlin Ave., Chicago 45, Ill.

TE-9

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated —

- ☐ Catalog #107—For Hydraulic Oils, Coolants, Lubricants
- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog #301—For Water

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Company.....

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City.....

State.....

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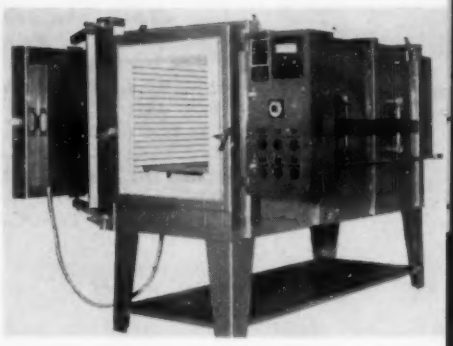

the thermocouple selector switch. There are six zones in the furnace; the input to each is controlled by an input controller which may be set from 7 to 100 percent of input in increments of 1 percent. Any rate of heating-up time may be selected.

Automatic control is attained by a combination of temperature controller with straight-line adjustments and a precise 30-hour timer. The temperature controller starts the timer on its timing cycle. When the cycle is completed, the furnace is automatically shut off. Cooling rate may then be selected by setting the controller to the desired rate.

Specially designed Dyna-Glow element holders offer good heat transfer properties. A low mass characteristic keeps overshoot and undershoot of the temperature control point due to minimum heat storage in the element holders to an absolute minimum.

L & L Mfg. Co., 136 8th St., Upland, Del. Co., Pa. **T-9-1681**

Wet Surface Grinder

Tolerances of 0.0002 in. are held with the Model 117 wet surface grinder, making it useful for jobs in both production and in the tool shop. The grinding wheel is 16 in. in diameter and takes work up to 42 in. high and 72 in. long. Feeds on both the spindle and the table are automatic. Automatic in operation, the machine completes full cycle without an attendant.

A special jig provides quick, easy setup and rolls over the work for two or more side grindings. V-ways on both tables and base are hand scraped. Forced-feed lubrication assures long, trouble-free life.

Tillis Mfg. Co., Elkhart, Ind. **T-9-1682**

Drill and Tapping Units

This vibration-free equipment assures accuracy and sensitivity in drilling and tapping small holes in delicate work. Drive motor frames on both drilling and

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-9-275	Ace Drill Bushing Co., Inc.	Drill Bushings—New catalog contains technical data, comparison tables, price lists and name of nearest dealer. (Page 275)
A-9-265	The American Brass Co.	Anaconda Alloys—Data on composition and machine ability standard specifications, weights and dimensions of standard rods available in Publication B-3. (Page 265)
A-9-13	American Drill Bushing Co.	Drill Bushings—Catalog contains data on bushings and 3-D method of ordering. (Page 13)
A-9-250-2	American Pullmax Co., Inc.	Special Machines—Catalog contains data on money-saving metal-working ideas. (Page 250)
A-9-12	The American Tool Works Co.	Radial Drills—Bulletin 328 contains data on American Radial drilling machines. (Page 12)
A-9-214	Armstrong Bros. Tool Co.	Toolholders—Catalog contains data on toolholders and carbide inserts. (Page 214)
A-9-263	W. F. & John Barnes Co.	Engineering—Catalog describes scope of Barnes machine tool building service. (Pages 262-263)
A-9-249	Bay State Abrasive Products Co.	Grinding Wheels—"Grinding Wheel specifications for Tool and Die Steels" now available. (Page 249)
A-9-281	Boston Gear Works	Sprockets—Interchangeable tapered sprockets and bushings listed in Catalog No. 56. (Page 281)
A-9-260-3	Cerro de Pasco Corp.	Material—Bulletin B5 gives data. (Page 260)
A-9-51	The Cincinnati Milling Machine Co.	Hydrospinning—Bulletin M-1873-3 contains hydrospinning data. (Page 51)
A-9-236	The Cleveland Crane & Engineering	Bending Press—Catalog No. 2010 gives construction and engineering details. (Page 236)
A-9-197-1	Arthur A. Crafts Co., Inc.	Carbide Form Tools—Catalog available on "Complete Carbide Tooling for Automation." (Page 197)
A-9-268	Crane Packing Co.	Surface Finish—Free booklet contains data on production lapping and light band reading. (Page 268)
A-9-193	Dearborn Gage Co.	Gages—48-page, illustrated catalog contains data on Master-setting rings and discs.
A-9-250-3	Detroit Stamping Co.	Toggle Clamps—Brochure contains data on De-Sta-Co Models 810-U and 810-S. (Page 250)
A-9-321	De Vlieg Microbore Co.	Toolholders—Catalog available on Flash-change toolholder. (Page 321)
A-9-204	H. E. Dickerman Mfg. Co.	Press Feeds—Full scale templates on all Dickerman hitch feeds, die feeds and Rol-Di-Feeds available upon request. Also catalog on Dickerman line. (Page 204)
A-9-210-1	The Eastern Machine Screw Corp.	Machine Threads—"Unified and American Screw Threads" digest sent upon request. (Page 210)
A-9-297	Ehrhardt Tool & Mfg. Co.	Special Machines—"Triple Plus" gives picture story of Ehrhardt's toolmaking skills and facilities. (Page 297)
A-9-276-2	Elgin National Watch Co.	Rotary Tools—Booklet contains data on Elgin "Golden Circle" Rotary tools. (Page 276)
A-9-IBC	Ex-Cell-O Corp.	Drill Bushings—Catalog contains data on Ex-Cell-O line of drill bushings. (Inside Back Cover)
A-9-171-1	The Gaertner Scientific Corp.	Microscopes—Bulletin 161-54 shows applications, models and specifications for toolmakers' use. (Page 171)
A-9-250-1	The J. C. Glenzer Co., Inc.	Toolholders—Folder gives data on Glencoe floating toolholders. (Page 250)
A-9-238	George Gorton Machine Co.	Milling Machines—Form 2697-ADS contains data on tracer-controlled machines. Also Catalog 2605-1655 describes the Gorton general line of machines. (Page 238)
A-9-186	Greenlee Bros. & Co.	Automatics—Catalog A-405 contains information on Greenlee automatic farm machines. (Page 186)
A-9-159	Handy & Harman	Brazing Wire—Bulletin 20 contains data on Easy-Flo brazing. (Page 159)

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Literature Number	COMPANY	DESCRIPTION
A-9-5	Hardinge Bros., Inc.	**Collets**—Bulletin 56 contains collet reference list for lathes, millers, grinders and fixtures. (Page 5)
A-9-IFC	The Heald Machine Co.	**Grinders**—Bulletin 2-2569-1, Issue 1 contains data on Heald Model 271 internal grinder. (Inside Front Cover)
A-9-266-2	The High Standard Mfg. Corp.	**Drills**—Engineering File "E" contains data on high standard deep-hole drills. (Page 266)
A-9-47	The Ingersoll Milling Machine Co.	**Cutting Tools**—Ingersoll Cutter Catalog 66F describes line of inserted blade cutters. (Page 47)
A-9-194	The B. Jahn Mfg. Co.	**Special Machines**—Brochure "No Hands . . . No Delay . . . No Error" contains data on application of B. Jahn machines. (Page 194)
A-9-175	Jarvis Corp.	**Cutting Tools**—Catalog available describing Jarvis production-increasing tools. (Page 175)
A-9-308-2	Jergens Tool Specialty Co.	**Work Holders**—Catalog contains data on jig and fixture components. (Page 308)
A-9-261	Kearney & Trecker Special Machinery Div.	**Machine Tools**—Data sheet No. 1080 contains information on new 12-station automatic transfer machine. Bulletin SMD-56 describes K & T designs of special machine tools. (Page 261)
A-9-9	Landis Machine Co.	**Thread Rolling**—Bulletin G-96 contains specifications for Landis thread rolling attachments. (Pages 8-9)
A-9-260-1	Louis Levin & Son, Inc.	**Lathes**—Catalog M describes line of instrument lathes. (Page 260)
A-9-280-4	F. J. Littell Machine Co.	**Roll Feeds**—Catalog contains data on Littell reels. (Page 280)
A-9-310	Metal Carbides Corp.	**Carbide Metal**—Catalog 56-G contains data on Talide metal. (Page 310)
A-9-176	Micrometrical Mfg. Co.	**Surface Measurement**—Bulletin LT14 contains technical aspects on surface measurement. (Page 176)
A-9-35	Niagara Machine and Tool Works	**Presses**—Illustrated Bulletin 66 gives data on Niagara straightside Eccentric geared presses. (Pages 34-35)
A-9-290-2	Northwestern Tool & Eng. Co.	**Setup Components**—Catalog 23 contains data on T-nut and stud sets, step block and clamp sets, and punch press sets. (Page 290)
A-9-44	Pines Engineering Co., Inc.	**Bending Machines**—Cross-cutting ideas in latest bending and end finishing techniques discussed in "Pines News." (Page 44)
A-9-43	The Pipe Machinery Co.	**Gages**—Catalog No. 14 contains operational data on pipe gages. (Page 43)
A-9-164	Ready Tool Co.	**Grinding**—Red-E new concept in the art of grinding explains grinding accuracy to within less than 0.000050" t.i.r. (Page 164)
A-9-181	Ring Punch & Die Co.	**Punches and Dies**—Catalog 105 contains data on Ring's standard punches and dies. (Page 181)
A-9-185	Seibert & Sons, Inc.	**Control Systems**—Circular T-10 contains data on new Seibert control system. (Page 185)
A-9-269	The Sheffield Corp.	**Grinders**—Bulletin MFG-121-C gives Micro-form data grinder. (Page 269)
A-9-177	The S-P Mfg. Corp.	**Cylinders**—Catalog No. 110 contains data on S-P standard air cylinders; Catalog 109-A, on Heavy-duty air cylinders; Catalog 104, on high-pressure hydraulic cylinders. (Page 177)
A-9-224-2	P. A. Sturtevant Co.	**Torque Wrenches**—Data included in "Torque Manual." (Page 224)
A-9-255	Sundstrand Machine Tool Co.	**Machine Tools**—Bulletin 771 contains facts on the Sundstrand Rigidmils. (Pages 254-255)
A-9-54	Super Tool Co.	**Cutting Tools**—New catalog available on super carbide tools. (Page 54)
A-9-69	Threadwell Tap & Die Co.	**Taps and Dies**—New "Threadwell Tap Primer" available upon request. (Page 69)
A-9-146	Twentieth Century Mfg. Co.	**Cutting Tools**—New selective catalog on reamers available. (Page 146)
A-9-48	The Van Keuren Co.	**Gages**—Catalog and Handbook No. 36 contains technical and engineering information on measuring problems and methods. (Page 48)
A-9-271	Willey's Carbide Tool Co.	**Cutting Tools**—Catalog contains data on tungsten carbide tools used for modern automation. (Page 271)

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Write for Bulletin 161-54 showing applications, models, specifications.

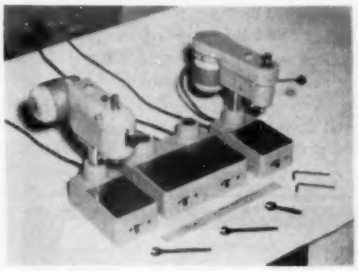
The Gaertner Scientific Corporation

1241 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335

INDICATE A-9-171-1

tapping units rotate with drive pulleys to produce a flywheel effect. Pulley and motor operate as an integral massive unit. Uniform tension is maintained on drive belts, assuring constant speed, no vibration, and high precision.

Power transmission to the spindles is applied by endless belts with means of adjusting tension. Spindle speeds on the drilling unit range from 3500 to 10,000 rpm. Tapper spindle speed is 1700 rpm for taping with a return speed of 2100 rpm. An adjustable positive stop controls tapping depth; when desired



depth is reached, spindle rotation automatically reverses for fast return. Drilling depth is controlled by a micrometer adjustment on the spindle of this unit.

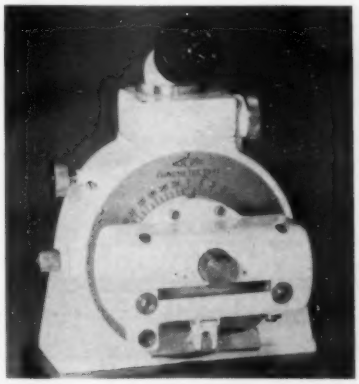
Accurate differential between the infeed handle and the spindle assures a sensitive feed when feeding into the work in both cases. A return spring provides a light pressure on the spindles during infeeding and returns the spindle to the normal position when the handle is released.

Drills and taps are accommodated in sizes up to 0.100 in. diam. Maximum depth of hole for drilling is 25/32 in. and for tapping 45/64 in.

Haller, Inc., 684 Ann Arbor Rd., Plymouth, Mich. **T-9-1711**

Clinometer

A precision clinometer, known as Type TB95, reads directly to 1 sec of arc. Features include an enclosed bubble, optical bubble-reading system,



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over ½" +.0000", −.0005"

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up to ½" +.0002", −.0000"
over ½" +.0005", −.0000"

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INDICATE A-9-171-2

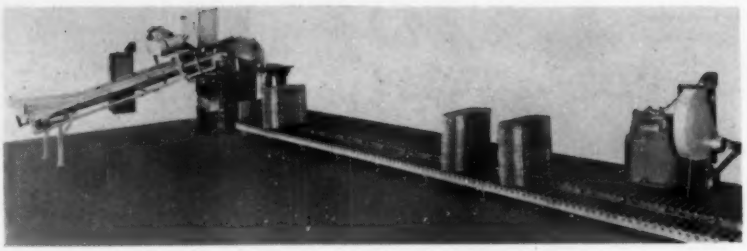
daylight as well as electrical bubble illumination, and sensitive bubble adjustment.

Entire leveling unit of the instrument can be removed and replaced by a table, work-holding fixture, or mirror attachment, to permit its use for testing circular spacing on gears, cams and other precision parts or as a universal testing device when used with the Watts Microptic auto collimator.

Distributed by Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. **T-9-1721**

Stacker-Conveyor

Press-to-Press Automat conveys, stacks, shuttles and stores sheet-metal blanks between the blanking press and presses for secondary operations. Blanks are conveyed to the stacker, fall



in a preload position and are held by retractable fingers, controlled by air cylinders. While from 5 to 10 blanks are allowed to preload, a previously stacked set of blanks is pushed from the stacker to the shuttle conveyor. On this conveyor, it is shuttled in steps until it reaches a position just behind the previous stack. There it is stored until it can be automatically fed to the secondary presses.

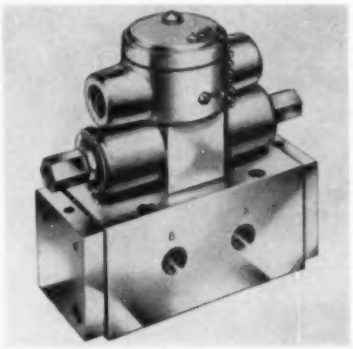
Operating cycle of the stacker is controlled by height of the stack which can be varied for specific needs. Length of the conveyor also may be varied to suit particular storage requirements. The shuttle conveyor, which may be constructed either with rollers straddling the shuttle bar or with solid guides, is operated by a motor and speed reducer. These same principles can be adapted to handling heavy castings. The chain feed conveyor and the shuttle conveyor are separately operated. The stacker also has its own control. Controls throughout the system are built to JIC standards.

Michigan Production Engineering Co., 1796 E. 9 Mile Rd., Hazel Park, Mich. **T-9-1722**

Air Valves

This series of Flo-Line Solenoid and master air valves is used for 3 and 4-way air operation. Valves are available in sizes of ¼, ⅜, ½, ¾ and 1 in.

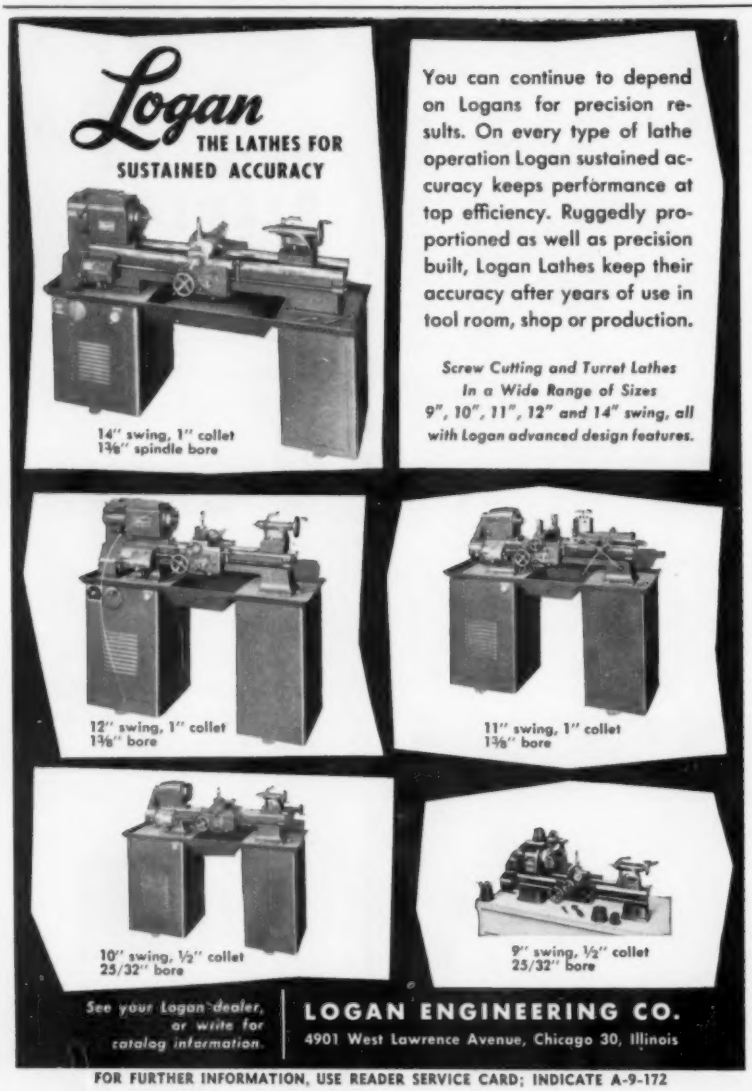
Used for controlling air cylinders and other air-operated devices, they provide



dependable performance, safe operation and easy maintenance.

Specially designed seals prevent damage from external grit and moisture. Construction involves only a few moving parts. Worn parts are easily and quickly replaced and there is no possibility of assembling the valve incorrectly.

Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill. **T-9-1723**


Logan
THE LATHES FOR SUSTAINED ACCURACY
14" swing, 1" collet 1⅜" spindle bore
You can continue to depend on Logans for precision results. On every type of lathe operation Logan sustained accuracy keeps performance at top efficiency. Ruggedly proportioned as well as precision built, Logan Lathes keep their accuracy after years of use in tool room, shop or production.
Screw Cutting and Turret Lathes In a Wide Range of Sizes
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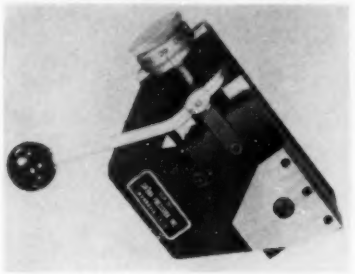
12" swing, 1" collet 1⅜" bore
11" swing, 1" collet 1⅜" bore
10" swing, ½" collet 25/32" bore
9" swing, ½" collet 25/32" bore
See your Logan dealer, or write for catalog information.
LOGAN ENGINEERING CO.
4901 West Lawrence Avenue, Chicago 30, Illinois
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-172

Single-Point Threading Attachment

Rapid, accurate engine lathe threading may be accomplished by semiskilled personnel with the SP-51 lathe attachment. It is easy to install on any lathe having a minimum 1 15/32-in. distance from the centerline to the top of the compound; it provides a solid tool support with a micrometer adjustable stop assuring repetition to 0.0005 in. in diameter.

Handle action permits fast pull-out from thread or work shoulder for close



work in tight spots. Smooth, sensitive feed allows the operator to "feel in" when machining snap and 0-ring grooves, and trepanning or cutting internal reliefs. The SP-51 can also be used on turret lathes when it is desirable to feed the tool in at an angle.

Sierra Precision Inc., 925 S. Magnolia Ave., Monrovia, Calif. **T-9-1731**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Welder and Positioner

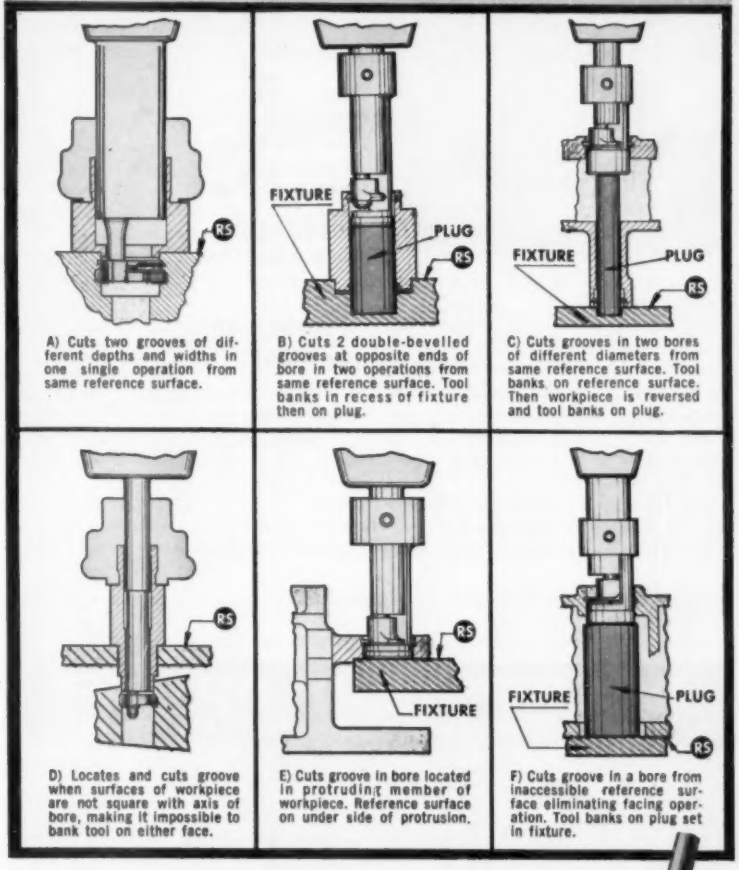
Automatic welding on circular shapes or longitudinal joints can be accomplished on this Rexarc RP roll and idler welder and positioner. The packaged unit is engineered for quick and easy change-over.

The automatic head operates with high torque and fast speed response. Wide changes of rod feed rate allow use of a variety of rod sizes and compositions with no change in gearing. Rod feed motor is designed for 110-v current and operates accordingly; arc voltage variation has little unfavorable effect.

The compact unit controls welding operations and rotates workpieces simultaneously with stopping and starting of arc. The high-frequency generator assures automatic start of the arc and stabilizes it during operation.

The varidrive and motor for rotation and variable-speed regulation give a 10:1 speed variation, with finger-tip speed control. Welding speed ranges

Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



A) Cuts two grooves of different depths and widths in one single operation from same reference surface.

B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.

C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks on reference surface. Then workpiece is reversed and tool banks on plug.

D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.

E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.

F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.

Amazingly versatile! Your toughest recess cutting problems can be met simply and efficiently with the Waldes Truarc Grooving Tool because it offers a whole range of possibilities beyond the range of ordinary recessing tools.

Wide Cutting Range! The Waldes Truarc Grooving Tool comes in 5 models...enabling you to cut accurate grooves in housings with diameters from .250 to 5.00 inches.

Send Your Problems to Waldes! Send us your blueprints...let Waldes Truarc Engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job. There is no obligation!

Write NOW for a 20-page manual containing full information on Waldes Truarc Grooving Tool

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TE-098
Waldes Kohinoor, Inc., 47-16 Austel Pl., L.I.C. 1, N. Y.
Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool.
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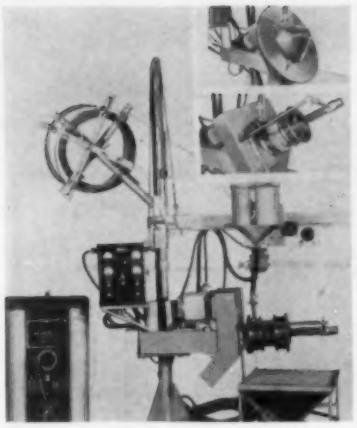


from 0.13 to 1.33 rpm.

The 120-deg tilting table provides adjustable positioning of the rotating shaft. The table will tilt from 30 deg below horizontal to vertical position. Shaft rotation is reversible. Sticking of the rod or extinction of the arc automatically stops rotation as protection against possible equipment damage.

The 500-amp a-c transformer welder has power factor correction.

The 100-lb visible supply Sight Feed flux hopper has a heavy transparent plastic strip on the side, and a clear plastic conductor tube.

A pair of cones for centering and holding workpieces fit diameters up to 4 in. These cones insure line-up and build-up concentric with rotating shaft, in any plane of operation. Fast, self-locking ring locks on shaft, providing quick, positive positioning of weldment.

Two adjustable wire reels are provided for welding wire coils 12 to 26 in. in diameter. They are rotatable in vertical plane with boom, giving straight-line dereeling. An insulated wire guide assures constant line-up of wire and reel roll.

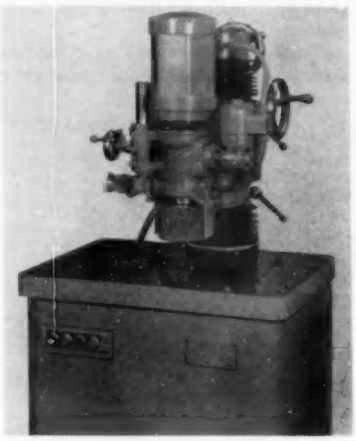
The Sight Feed Generator Co., West Alexandria, Ohio. **T-9-1741**

Profiler and Contour Grinder

Heavy-duty master profiler and contour grinder permits fast and accurate free-hand rough and finish profiling. It also will precision grind large die sections to close specifications in minimum time.

A precision spindle supported by a heavy column and over-arm serves as a mounting for the grinding wheel. Wheels (including cup type) range in size up to 6 in. in diameter by 4 in. in height. Power is supplied by a completely enclosed 2-hp motor remote-controlled by pushbutton.

The grinding wheel may be either oscillating (⅜-in. stroke at 72 strokes per minute) or nonoscillating; separate oscillating motor is controlled by



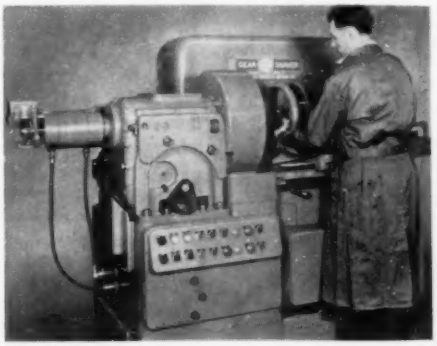
remote pushbutton. The wheel can be tilted from 0 to 5 deg by a handwheel adjustment and can be raised from table level to 10 in. above.

A specially designed grinding wheel guard swivels on the spindle quill and locks in any desired position. A diamond wheel dresser is an integral part of the machine, and the wheel can be dressed without changing elevation of head or degree of tilt.

The Kindt-Collins Co., 12651 Elmwood Ave., Cleveland, Ohio. **T-9-1742**

Internal Gear Shaver

Red Ring Model GCR internal shaver is designed to incorporate a semiautomatic loader to avoid hand loading and cutter mashing procedures in shaving internal spur and helical gears from 3 to 12 in. in pitch diam having teeth up



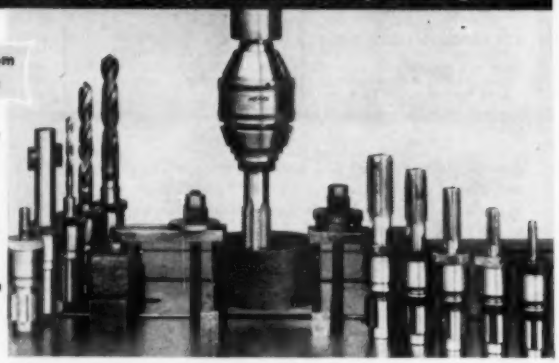
DOUBLE YOUR OUTPUT

Pre-Determined Tapping Torque Eliminates Tap Breakage

Tap To A Blind Bottom With No Breakage

'JAY-DEE' Universal Attachment

No Adjustments When Changing Size of Tap



PLUS THESE OUTSTANDING FEATURES:

- No Vertical Pounding when Bottom Hole Tapping.
- Same Tap Adapters for all Metals.
- Virtually no working parts to go wrong.
- No Springs or Ball Races to wear out.
- Short Body Lengths.
- Pre-Determined Tapping Torque.

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A few desirable distributorships available!

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to 4 diametral pitch and tooth face widths up to 2½ in.

The operator merely hangs the gear to be shaved on the shaving cutter, presses a cycle control button and removes the gear from the workhead after shaving.

The workhead on this model permits taper shaving operations to be performed on internal gears. Either conventional shaving operations with cutter reciprocation or plunge-cut shaving without cutter reciprocation is possible. Air cylinders operate the work-holding fixture, and the cutter head advance and retract motions. A transparent plastic insert in the cutter guard enables the operator to view the shaving operation during the cutting cycle.

Change gears are provided for work spindle and cutter reciprocation drives. All electrical controls are JIC standard and mounted in a panel at the rear of the machine. Pneumatic controls are in a separate compartment in the machine base directly below the electrical panel.

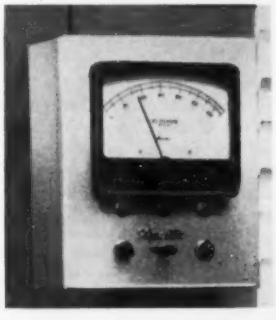
National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich.

T-9-1751

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Remote Positioning Control System

Positioning and proportioning plus monitoring of remote equipment over one circuit is possible with this variable remote control system. Polarized d-c signals transmitted from a supervisory control panel to a remote slave receiver determine bi-directional positioning. Quantitative data on the controlled



function is transmitted from the slave unit back to a meter on the supervisory panel.

This system features package "building block" module construction which can be installed by a plant electrician. As control requirements change or increase, modules can be added without extensive modification. It may be used in conjunction with existing operators

modern MACHINES *demand*

MODERN *solid carbide* TOOLING!

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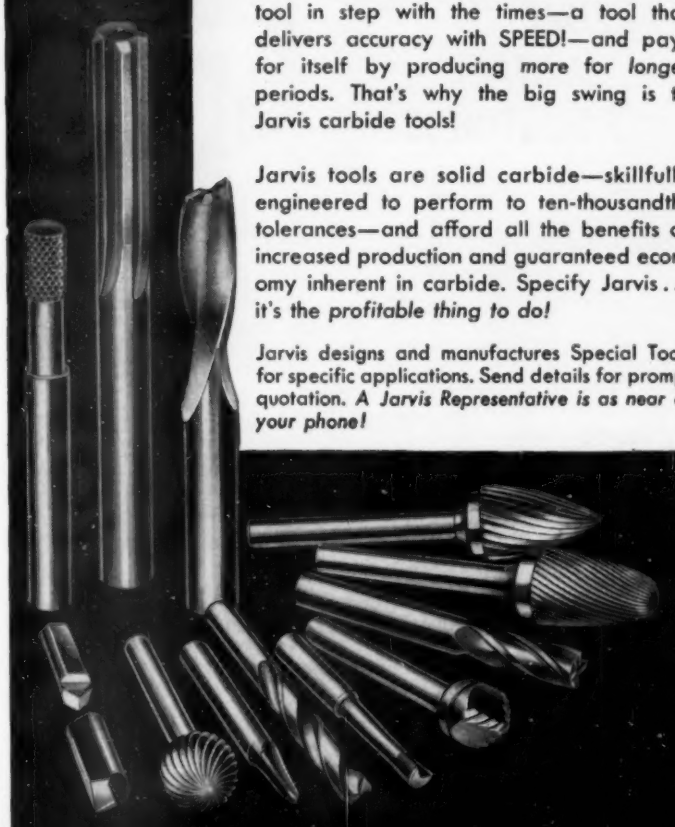
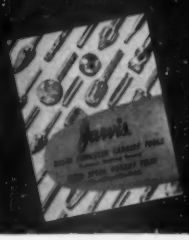
Jarvis tools are solid carbide—skillfully engineered to perform to ten-thousandths tolerances—and afford all the benefits of increased production and guaranteed economy inherent in carbide. Specify Jarvis... it's the *profitable thing to do!*

Jarvis designs and manufactures Special Tools for specific applications. Send details for prompt quotation. *A Jarvis Representative is as near as your phone!*



Send today for catalog describing hundreds of Jarvis production-increasing tools.



Jarvis CORPORATION

POWER TOOLS FOR INDUSTRY

MIDDLETOWN, CONNECTICUT

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or can be supplied complete with reversing motors and pilot operators up to several horsepower. It is also available with transducers for telemetering various functions. Visible and audible alarm as well as fail-safe, lock-out and hold-out features, can be added for complete supervision of the remote equipment.

Over-all accuracy of the metering system is better than 2 percent. Wall-mounted and switchboard-mounted units are available; the units are also readily adaptable for incorporation in other switchgear or control systems.

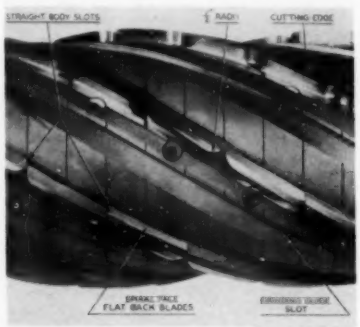
Sparton Control Systems Division, The Sparks-Withington Co., Jackson, Mich. **T-9-1761**

Brass Slab Milling Cutters

These brass slab milling cutters are designed so they do not produce longitudinal ridges when milling the scale from partially worked brass slabs before final rolling operation.

Six rows of standard spiral-faced flat HSS one-position blades are wedged in straight body slots. This construction permits uniform absorption of wedge pressures, minimizes strain and blade breakage. Because cutting edge is on a helix, heavy peripheral cuts are possible. A guide slot in a the cutter body simplifies grinding.

Using a coarser pitch prevents heat and results in longer life while also



providing the advantage of blade economy and low cutter maintenance costs. Accuracy in manufacture means customer work on the blades and involves only clearing the periphery. Blades can be assembled in any position in the bodies and will maintain alignment.

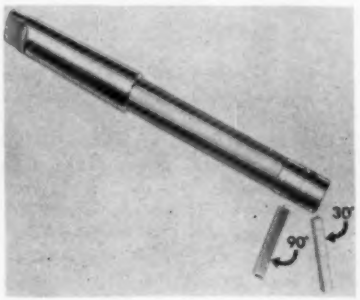
On production test runs on brass, the slab milling cutters have been operated at 1500 rpm with a 60-fpm feed. On high-nickel and similar alloys, 900 rpm with a 40 to 48-fpm feed is recommended.

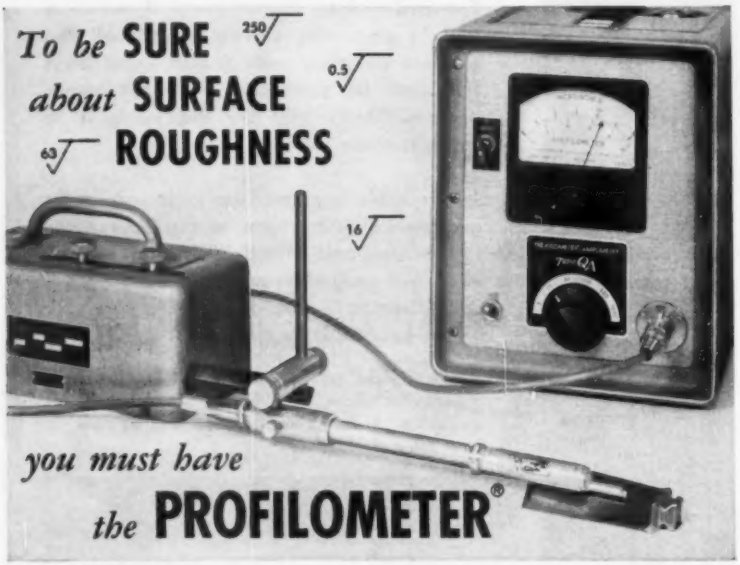
Goddard & Goddard Co., Detroit 23, Mich. **T-9-1762**

Boring Bars

Standard type shank boring bars incorporate two square tool bit holes in the same boring bar.

The new boring bars are available with No. 4 and No. 5 Morse taper shanks for use on radial drills, tailstocks of lathes, turret lathes, boring mills and jib borers, as well as horizontal and vertical milling machines.





Here's why:

1 The Profilometer measures surface roughness height, in microinches (arithmetical or r.m.s. average). It lets you *select, specify* and *measure* roughness in *definite numerical terms.*

2 It is *accurate* and *dependable* — even below 10 microinches. Eliminates the errors and uncertainties of inspection by touch or sight. Cannot be set to give wrong readings.

3 It's a practical, portable "shop tool" — convenient and *simple to use.*

4 It's been *thoroughly proven* in thousands of production and inspection departments — *since 1936.*

FREE 8-PAGE BULLETIN gives details on these and other features; describes cost-saving applications. *Write for BULLETIN LT14.*

Profilometer is a registered trade-mark.

MMC MICROMETRICAL MANUFACTURING COMPANY

349 S. MAIN ST. ANN ARBOR, MICHIGAN

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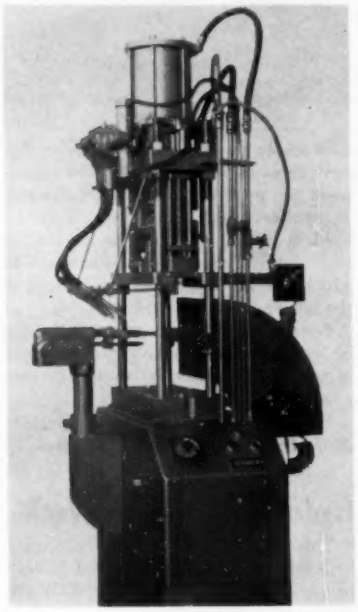
Use of reducing sleeves allows their adaption to machines with spindles other than No. 4 and 5 Morse taper. Any standard tool bit may be used with the boring bars. Each has a hardened and ground surface on the tool bit end for accurate setting and long life.

Beaver Tool & Engineering Corp., Box 429, Royal Oak, Mich. **T-9-1771**

Molding Press

A 25-ton, automatic, air-operated low cost compression molding press of simplified design is suitable for short production runs where low mold costs and quick mold setup, as well as automatic molding, are desired.

This Model 725 press can be equipped with a universal chase plate which permits cavities to be changed quickly



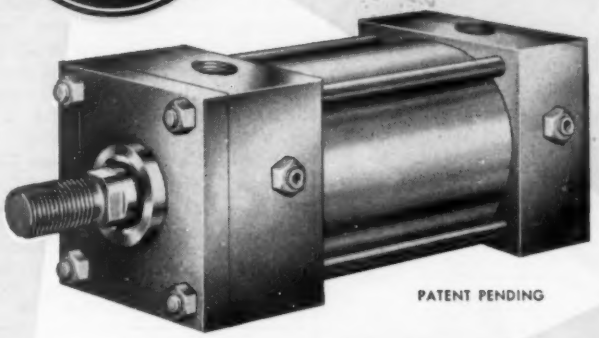
without taking the chase plates from the press. It also has an easily adjustable 3-station rotary feeder, a separate cam-actuated air-ejection system, and an air-operated push off which can be sequenced in at any point in the press' open cycle. Either top ejection or bottom ejection with top hold-down is possible, with a maximum ejection stroke of 2½ in.

The bar controller provides for fast and easy changeover in the molding cycle to accommodate bumping, breathing and multiple air blast. A design feature prevents the mold being closed unless all of the moving members are free of the molding area.

The press exerts pressure by means

FOR AUTOMATION

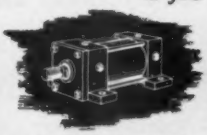
S-P CYLINDERS



PATENT PENDING

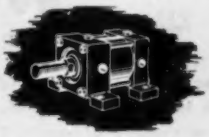
top performance–longest life

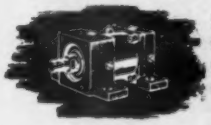
All S-P cylinders are engineered throughout for high speed, efficient operation. Piston rods are heat treated and hard chrome plated to resist scoring. Bronze cartridges with extra long bearing surfaces are easily removable for quick servicing of rod seals and wipers. End plates are rolled steel. All S-P cylinders are built to JIC standards.



S-P STANDARD AIR CYLINDERS have brass tubes to eliminate corrosion. Cushions float on O-rings for maximum cushioning. Eleven bore sizes, 1½" — 14". 21 mounting types. Readily modified for oil or water. Send for Catalog No. 110.

S-P HEAVY DUTY AIR CYLINDERS for automation and other severe applications. Double porting for extreme high speeds. Heavy wall seamless steel tube. Nine bore sizes, 1½" — 8". Five mounting types. Approved and used by two major automobile manufacturers. Send for Catalog No. 109-A.





S-P HIGH PRESSURE HYDRAULIC CYLINDERS have seamless steel tube. Special locking mechanism eliminates tie rods. Designed for 2,000 psi. Eleven models in 11 sizes. Send for Catalog No. 104.

Step up production with S-P cylinders. Representatives in principal cities. Prompt deliveries. Order catalog by number shown above. The S-P Manufacturing Corporation, 30201 Aurora Rd., Solon, Ohio. *In greater Cleveland.*

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THE S-P MANUFACTURING CORP.

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POWER CHUCKS • COLLET AND DRILL PRESS CHUCKS • AIR PISTONS, VALVES, ACCESSORIES

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ROUSSELLE

THESE 40-TON PRESSES

take job after job in stride and give you top speed and uniform output on a variety of work. They stress simplicity in every detail to achieve quicker set-ups, easier changeovers and simpler operation. All are extra rugged, high precision units, made to withstand hard usage and assure long, satisfactory service. They are *very moderately priced.*

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Rousselle Presses are sold exclusively through leading machinery dealers.

Choice of 25 models in 5 to 40-ton sizes.

Manufacturers of Rousselle Presses

SERVICE MACHINE CO.

2310 WEST 78th STREET

CHICAGO 20, ILL.

INDICATE A-9-178

of a 7-in. main ram cylinder whose action is multiplied by a toggle arrangement to provide fast initial closing and relatively slow final closing, to match the flow of materials into the mold. It has an overall dry cycle time of 5 seconds, which includes feeding, closing, opening and ejection, exclusive of curing.

Capacity of the Model 725 is 25 tons; press stroke is 5 in.; ejection stroke (top and bottom) is 2½ in. max. and hold-down pin stroke is 1¼ in. max. Daylight when the press is open is 22½ in., while daylight in bed plate to ram with press closed is 12 to 17 in. Platen area, left to right and front to back, is 11½ by 6 in.

Plastics Molding Equipment Div., F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa. **T-9-1781**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Point Indicator

Computing and layout time in joining, shaping, drilling and milling is reduced through use of this point indicator which is a combination angle-finding, center-locating, center punching and leveling device.

Called the Miracle Point indicator, it consists of a mercury-balanced level

and degree-calibrated dial enclosed and mounted on a magnetized V-base.

It automatically determines angles and center points to an accuracy of within 3 min. of a degree.

Two Alnico-V magnets in the base hold the indicator in contact with metallic objects, leaving the worker's hands free to adjust the work to the correct angle.

Racine Instrument Co., 500 College Ave., Racine, Wis. **T-9-1782**

Boring Tools

Standard microadjustable boring tools employing indexable throwaway carbide tips are fitted with a vernier-screw adjustment for diameter of cut. The circular dial has 20 graduations, each graduation representing a total of 0.001 in. so that each complete revolution of the screw is equivalent to an advance or retraction of 0.020 in. Head of the adjusting screw is positively pulled up and locked against a locating face after the adjustment is made to prevent backlash.

An adjustable built-in chip breaker

also serves as clamp for the boring tip. Serrations on the clamp provide adjustment for positive chip control. Round, square or triangular inserts may be used in these tools. Except for the tip and the adjustable anvil-locator in which the tip is mounted, all parts of the boring tools are identical.

Because the cutting edge of the tip is located slightly above center, there is no relief grinding below the cutting edge.

Wesson Co., 1220 Woodward Heights Blvd., Ferndale 20, Mich. **T-9-1783**

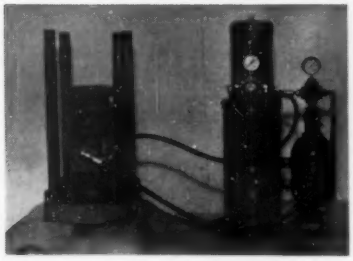
Hydraulic Press Bed Jack

This press bed jack is a precision hydraulic relief device designed for use in punch presses where one or more operations, such as briquetting, coining, embossing, marking, pressing, riveting, sizing, stenciling, staking, sub-assembly or swaging are being performed.

It may be mounted either to the bolster plate of the press or fastened to the press bed proper. In the latter manner, it allows removal of the bolster plate without disturbing the press bed jack.

This unit serves as a safety overload means for the average press. When a preset tonnage is reached the jack automatically relieves, allowing precise control of the operation even though variations are present in the stock.

Design of the jack causes it to withstand cycling every time the press cycles while operating at full rated tonnage. However, if the jack is to be used only



as a safety release device, the hydraulic circuit can be revised and tonnage ratings increased 2½ times. Maximum allowable tonnage of the 4 models available range from 19 to 66; maximum air pressure used (psi) is 30; maximum oil pressure (psi) is 3000. When the prescribed pressure is attained in the die, pressure pins force jack to retreat and proper forming of work is accomplished.

A pneumatically operated hydraulic pump provides initial charging of the system and automatically maintains this charge. An air loaded relief valve is inserted in the system to aid initial bleeding and to act as a safety pop-off valve.

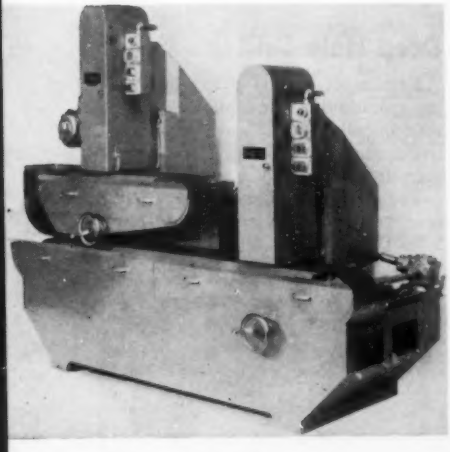
Dayton Rogers Mfg. Co., 2824 13th Ave., South, Minneapolis 7, Minn.

T-9-1791

Abrasive Belt Grinder

For high-speed precision surfacing both sides of flat parts, this two-level conveyor type wet or dry belt grinder features a dual conveyor arrangement, with turnover hopper device. Particularly adaptable to automatic production lines, it is designed to grind both sides of ferrous and nonferrous metals, plastics, glass, ceramics, and other materials in a single automatic cycle. The turnover hopper device can be sectionalized for smaller parts.

Speed of conveyor belts with ½-hp conveyor drive, is 2 to 25 fpm, with



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Wilson Diamond "Brale"* Penetrators

A Minor load penetration

B Major load penetration

C Linear measurement of penetration increase

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WILSON "BRALE" Penetrator

• WILSON Diamond "Brale" Penetrators are precision ground under high magnification to assure mathematical and microscopic accuracy. Each is standardized on test blocks and rigidly inspected at the WILSON Standardizing Laboratory.

Because of this meticulous attention to manufacturing detail, WILSON Diamond "Brale" Penetrators provide the extreme accuracy demanded of an instrument where the difference between a single degree of "ROCKWELL" reading is but 0.00008" penetration.

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A WILSON *expert on hardness testing is never more than a few hours away. Prompt* WILSON *service guarantees top performance from* WILSON *equipment.*

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Wilson Mechanical Instrument Division

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AMES

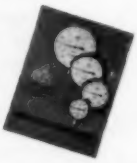
Long Range Dial Indicators

Check Motions or Dimensions
In .001" up to 10" Range.

Ames Long Range Dial Indicators in a variety of models are made for quality control applications requiring close tolerance and inspection. For example, you can measure in .001", long slide travel, large cams, deep recesses or other dimensions requiring indicator spindle travel of up to 10".

In addition, Ames Long Range models have all the advantages that are built into Ames regular indicators:—dials of large diameter; easy-to-read, widely spaced graduations; movable dials; replaceable contacts. All Ames Long Range indicators have count hands to indicate revolutions of the indicator hand. Those with box covered, rack guide have a slot in the cover graduated to register each inch of spindle movement.

Write today, sending your problem in long range measuring. Ames will be glad to suggest a solution. Be sure to include drawings and specifications—your answer will be back faster if you do.



Representatives in principal cities

B.C. AMES CO.

30 Ames Street, Waltham 54, Mass.

MANUFACTURER OF MICROMETER DIAL GAUGES • MICROMETER DIAL INDICATORS
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-180

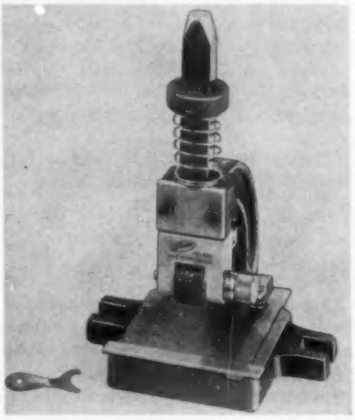
higher speed ranges available for special applications. For operator safety, the machine will not start unless the belt is tensioned. Control panels include tension safety light and conveyor reversing switch.

Size of abrasive belts is 10 x 92 in.; belt speed is 550 sfpm. Magnetic chucks are optional.

Engelberg Huller Co., 831 W. Fayette St., Syracuse 4, N. Y. **T-9-1801**

Numbering Heads

Design of these numbering heads incorporates a manual ratchet control to quickly set new numbering sequences. The units are available in standard or custom models. The custom model is especially constructed to user's specifications, incorporating any number of



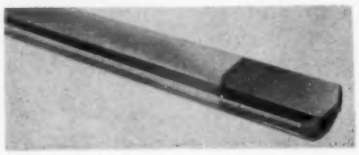
wheels, numbers, symbols or codes, and are especially adapted for clear, legible stamping in small, confined areas on practically any soft material. The heads can be adapted to fit any conventional press or marking machine.

The Parker Stamp Works, Inc., Hartford, Conn. **T-9-1802**

Deep-Hole Drill

Regular or special production drilling operations to any depth may be done economically with this deep-hole drill. Drills range from 0.125 to 3½ in. in diameter.

The drill is designed to operate in a confined space, and cuts a true round hole. Oil is forced through the shank



directly to the cutting edge, where it acts both as a coolant and lubricant, forcing chips out through its single flute without retraction.

The drill cuts at high speed through materials which normally cannot be drilled successfully. The unit offers long tool life between grinds.

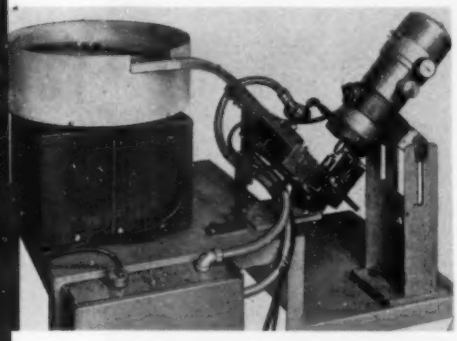
Basically the gundrill consists of three elements: a cutting tip, a tubular fluted shank and a driver by which the drill is held in a spindle adaptor or a stationary holder. Variations of driver design are possible. Outer nose angle and inner nose angle of the drill also can be varied.

Eldorado Tool & Mfg. Corp., 342 Boston Post Rd., Milford, Conn. **T-9-1811**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Deburring Machine

This small machine deburrs metallic or nonmetallic parts automatically. In the application illustrated, washers are deburred at a rate of 3000 pieces per hour. A hopper feeder positions the part so that the face to be machined is upward. From the feeder, a piece goes

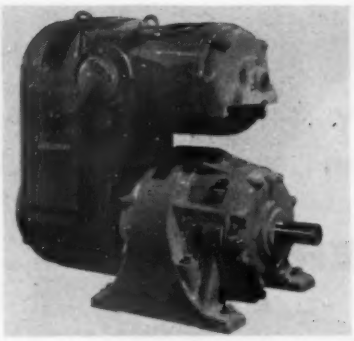


through an escapement to an air-operated vise which positions and holds it for deburring. A drill head feeds, machines and retracts. The part is then ejected and the cycle repeats. All operations are synchronized and automatic.

The Klaas Machine and Mfg. Co., 4314 E 49th St., Cleveland 25, Ohio. **T-9-1811**

Adjustable Speed Motor

Internally geared Varidrive motor, with take-off shaft and motor on the same side, is available for low-speed applications requiring variable speed, where weight distribution and limited space are factors. Designated Type



VEV-1-GD (double reduction) and Type VEY-1-GM (triple reduction) the compact units are available up through 5 hp, in upright and horizontal assemblies, with either dripproof, totally enclosed or explosion-proof motors. They use no separate gearboxes, speed changers, extra coupling or guards.

Lubriflush system of lubrication provides the largest volume of grease surrounding the bearings and relubrication without disassembling the unit.

U. S. Electrical Motors Inc., Box 2058, Terminal Annex, Los Angeles 54, Calif. **T-9-1813**

to economize
STANDARDIZE *with* RING

precision PUNCHES and DIES

Ring Standardized Punches and Dies offer cost saving dependable performance for all of your perforating problems.

Precision volume production to rigid specifications offers

★ Low cost
★ Complete interchangeability
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MANY SHAPES AND TYPES

ROUND SQUARE OBLONG HEXAGON RECTANGULAR

Blanks — Pilots — Headless — Shoulder and Bevel Head Quills — Slug Ejector Punches — Transfer Punches

NEW! Tough — Accurate Retainers for Ring Punches and Dies mount easily to your die set. Available in Key Type for irregular shapes.

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Gentlemen: Please send me a copy of your new, complete CATALOG #105 at once.

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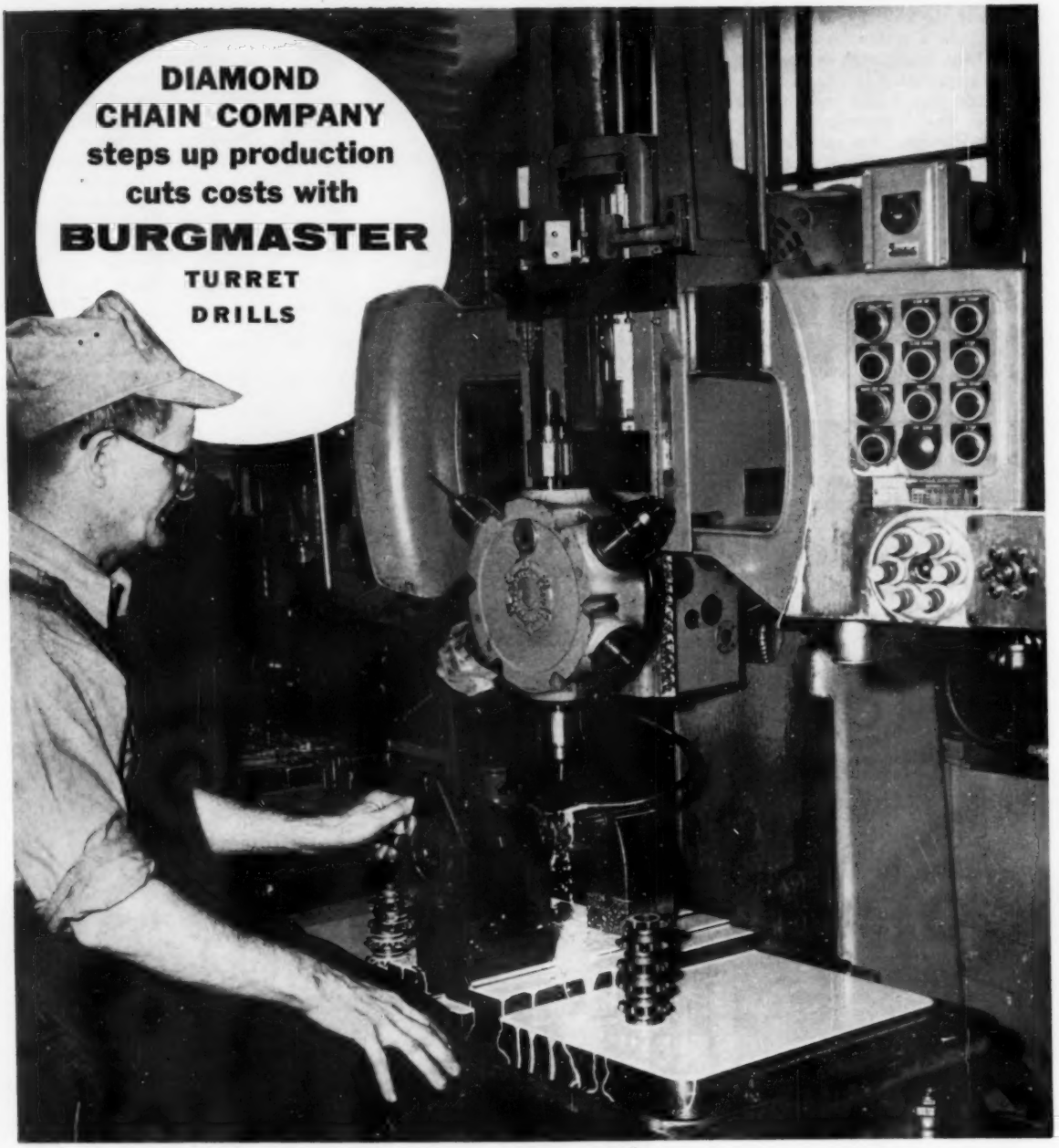

"THE BURGMASTER automatic hydraulic turret drill at The Diamond Chain Company plant has proven very satisfactory. The ease of selecting and setting the available wide range of speeds, feeds and stroke length of each turret spindle makes the machine very adaptable for center drilling, countersinking, drilling and tapping set-screw holes in steel sprocket hubs. Tool breakage has been reduced through the use of Burg tool holders, tapping heads and the adjustable hydraulic feeding pressure."

This experience is far from unique. If you are not now experiencing the improved quality of work and production savings possible with the BURGMASTER, write now for descriptive literature covering all models.

For complete information, write Dept. TE-9

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CHICAGO: Burgmaster Machinery Co. 5329 Lincoln Ave., UPtown 8-7161

SAN FRANCISCO BAY AREA: Paul A. Kulju 857 Estabrook Street, San Leandro, Calif. LOckhaven 9-2244

Men at Work

Among a number of changes of management personnel made by Dodge Mfg. Corp. was the election of **Carl W. Petersen** to the office of executive vice-president. Mr. Petersen formerly was vice-president and works manager. At the same time, announcement was made of the promotion of **Earl Wedlake,** who has been director of purchases and production manager, to vice-president of the company. **Lloyd F. Lamm,** who has been vice-president and general manager of Chicago Thrift-Etching Corp. since 1944, was elected president of that company, a subsidiary of Dodge Mfg.

Changes in executive personnel of Ace Drill Bushing Co., Inc. involved **George Clement** who was made vice-president in charge of manufacturing; **Del Herrick** who became vice-president for special assignments, and **George T. Smith** who was elevated to vice-president in charge of sales. Mr. Clement formerly was production manager. Mr. Herrick has been vice-president in charge of manufacturing, and Mr. Smith was previously sales manager for the company.

Election of **Charles H. Crawford** and **W. W. Wood** as vice-presidents has been made public by Colonial Broach & Machine Co. Mr. Crawford formerly was plant manager of Colonial Broach, while Mr. Wood previously was general manager of Colonial Bushings, Inc., an affiliate of Colonial Broach.

Several promotions have been made public by F. J. Evans Engineering Co. **J. K. Hawk** of the Birmingham, Ala., office was elected a director and vice-president in charge of engineering. **N. B. Buehrer,** also of the Birmingham office, was elected to the newly created office of executive vice-president. **D. M. Mills** of the Houston, Tex., office, was elected vice-president in charge of the Houston Div. **Jack J. Tyson** of the Atlanta office was elected vice-president in charge of the Atlanta Div.

Herbert Geittman, Jr. has been put in charge of Climax Molybdenum Co.'s development effort on castings for the machine tool industry. He has been with Climax for the past year as a cast iron specialist.

Kearney & Trecker Corp. has announced election of **J. Robert Jones** as vice-president in charge of sales and the appointments of **H. K. Kippers** and **Carl F. Enroth** as sales managers of standard machinery division and special machinery division respectively. Mr. Jones has been general sales manager for the past year, and prior to that headed the standard machinery sales program. Mr. Kippers who has been with Kearney & Trecker since 1939, was sales manager of the special machinery division. Mr. Enroth, a member of the Kearney & Trecker organization for the past 17 years, served as sales engineer in the special machinery division during the past three years.

Detroit Broach & Machine Co. has announced appointment of **Joseph P. Chayka** as chief engineer of the company. Previously he was machine and fixture engineer.

Jack J. Begley has been named vice-president in charge of manufacturing of The Colson Corp. Prior to this appointment, he was assistant to the president of the company.

Frank H. Wark, Sr., until recently chief engineer of the St. Joseph Div. of Whirlpool Corp., has been appointed director of engineering of Wheeler Associates, Inc. Prior to 1950, when he joined Whirlpool, Mr. Wark headed his own consultant organization.

Duncan Gardiner was made director of research and development for Vickers, Inc., responsible for programs which supplement development activities of the company's product groups. Associated with Vickers since 1934, he has been assistant chief engineer since 1950.

James R. Keough has been appointed manager of manufacturing at Fenwal Inc., responsible for production, manufacturing methods, quality control, standards and systems, and purchasing activities. He has been associated with the firm since 1951.

Bernhard W. Weber has been appointed manager of manufacturing for the Metal & Thermit Corp. A member of the M & T organization since 1949, he previously was production manager, a post now held by H. Alfred Rack, former manager of engineering.

Scovill Mfg. Co. recently announced two appointments in the newly formed Forging and Screw Machine Div. **W. H. Machin,** associated with the company for 38 years and formerly superintendent of its Screw Machine Products Div., was named manager of the new division. **N. J. Schaffer,** who joined Scovill in 1939, and served most recently as production manager of the Screw Machine Products Div., was made factory superintendent of the new division.

Election of **Walter W. Finke** as president of Datamatic Corp. was announced by the firm's board of directors. Formerly vice-president and general manager, he succeeds **John J. Wilson** who continues as a director.

Appointment of **Edward J. Vargo** as plant manager has been announced by Alloy Precision Castings Co. Prior to this promotion, he was chief metallurgist of the company.

Two executive appointments at Raybestos-Manhattan (Canada), Ltd. involved **J. Stewart Munro,** who became president of the Canadian company, and **Douglas Pocock,** who assumed the newly created post of vice-president, replacement sales. Mr. Munro, who was vice-president of the firm, succeeds **Robert Abbott,** who, although retired, will remain as a Canadian director of the company. Mr. Pocock has been sales manager of the organization since 1940.

At its recent annual meeting, the board of directors of Peninsular Steel Co. of Michigan elected the following officers: **James H. Kurtz,** president; **William I. Trader,** executive vice-president; **Richard J. Kurtz, F. W. Seyler** and **Wesley A. Kurtz,** vice-presidents; **James A. Couper,** secretary-treasurer; and **Walter L. Kurtz,** assistant secretary-treasurer.

New officers elected by the Drop Forging Assn. at its annual meeting are **Charles H. Smith, Jr.,** president, **Gordon R. Walker,** vice-president, and **Richard Marcus,** secretary-treasurer. Mr. Smith is president of The Steel Improvement & Forge Co., and Mr. Walker is president of Walker Forge, Inc. Mr. Marcus is an association staff member.

New vice-president of Sutton Engineering Co. is **O. J. Skawden.** Associated with the firm since 1927, he will continue as chief engineer at its Belefonte, Pa., plant.

At the same time, the company announced appointment of **Ray A. Bland** as sales manager of the mechanical equipment department.

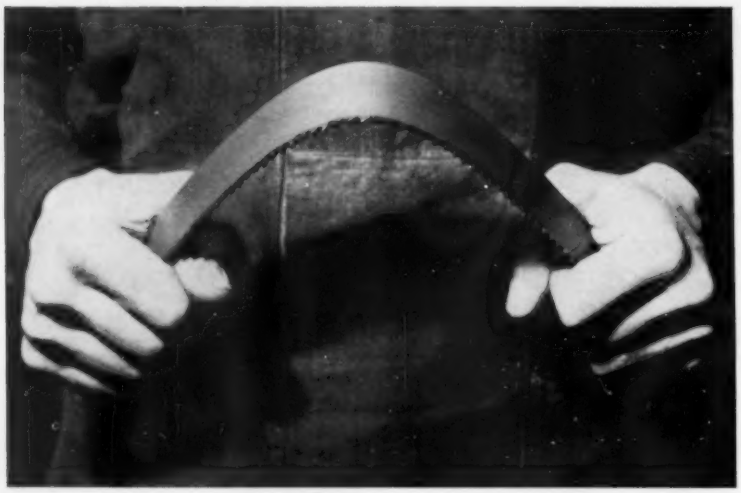
J. E. Williams has been appointed vice-president and general manager of the Western Brass Mills Div. of Olin Mathieson Chemical Corp. He also will direct the company's brass mills operations at New Haven. He previously was vice-president for operations for the Metals Div.

D. T. Wellman, president of Wellman Bronze and Aluminum Co., was recently re-elected president of the Magnesium Association.

Newly elected officers of the Alloy Casting Institute are **Bradley B. Evans,** president, and **F. M. Fahrenwald,** vice-president. Mr. Evans is sales manager of Empire Steel Castings, Inc. Mr. Fahrenwald is president of the Fahralloy Co. **E. A. Schoefer,** was reelected executive vice-president and treasurer.

Hugh F. Colvin is new president of Consolidated Electrodynamics Corp., succeeding **Philip S. Fogg** who will continue as the company's chief executive officer. Mr. Colvin, who has been vice-president and general manager of the firm, will be responsible for general management and daily direction of the business.

David W. Thomas has been named manager and **Albert Lang** assistant manager of the Chicago plant of Solar Steel Corp.



THIS is No Ordinary Power Hack Saw Blade

This is the *unbreakable* MARVEL High-Speed-Edge Hack Saw Blade—the first bi-metal blade—invented, developed and introduced by MARVEL. This blade is a combination of two materials best suited to the requirements of an efficient hack saw blade . . . a narrow high speed steel cutting edge permanently welded to a tough, non-brittle alloy steel body. Each blade is triple tempered to assure long life and maximum toughness to the cutting edge.

With a MARVEL Blade, you can cut any material—from the free machining steels to the toughest alloys . . . fast, accurately and economically. You can tension a MARVEL Blade from 200% to 300% tauter than any ordinary blade, permitting much higher speeds and heavier feeds without deflection or breakage.

Like all good things, attempted copies of the MARVEL Blade have been numerous, but its performance has been *unequalled* by any of the imitators. Ask for MARVEL Blades by name and you can be sure you're getting the best on the market. Leading Industrial Distributors have them in stock.

Write for latest cutting tool Bulletin and the name of your nearest MARVEL *Distributor.* FB-1020

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Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 W. Bloomingdale Ave., CHICAGO 39, U.S.A.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-184

technical Shorts

ELECTRONIC EXPERTS are hailing development of a tandem transistor by the Marvelco Electronic Div. of National Aircraft Corp. for use in the semiconductor field. The new component, developed by Dr. H. E. Hollmann, Marvelco director of research, is a d-c coupled, two-stage cascade housed in a single case, and is not a twin or dual transistor with two independent semiconductor elements.

Develop Tandem Transistor

Available in limited quantities for laboratory use at present, production in commercial quantities is expected to begin shortly. Predicted applications are as a high-gain amplifier, oscillator, multivibrator, switching device, etc.

In the tandem transistor, a common-collector transistor stage is the input device of a second transistor to serve as a useful type of d-c transformer. Current gain reaches values as high as 75 db, while high input resistance and low output resistance permit tandem transistors to be driven by high-impedance sources and to be cascaded by means of RC-coupling without necessity of matching transformers. No extra power is required because the input transistor forms the base leak for its successor.

* * *

STRENGTH OF adhesive bond material used by airframe, missile, and helicopter manufacturers, can now be checked without destruction of the unit under test. The ultrasonic bond analyzer, developed by Stanford Research Institute under contract to Wright Field, weighs 125 lb, is about 20 x 20 x 22 in. in size, and consumes 250 watts (including the cathode-ray oscillograph). It has a maximum R-F power output of 2 watts in the range of 170-1500 KC.

Nondestructive Tester for Bonded Materials

According to Emil G. Nichols of the Allen B. Du Mont Laboratories, Inc., availability of the equipment will remove a major obstacle blocking fullscale use of honeycomb construction in high-speed aircraft and missiles.

Honeycomb construction has important heat resistance and strength properties. It is being used, along with laminated metals, in helicopter blades and in some aircraft and missiles. Also, a large portion of military aircraft wings use honeycomb construction with a corresponding increase in strength and a saving in weight over previous riveted-metal techniques.

The ultrasonic bond analyzer consists of a sweeping oscillator and a barium-titanate transducer and incorporates a cathode-ray oscillograph and an oscillograph-record camera.

The crystal transducer applies ultrasonic stresses to the piece under test, and the instrument, through a method of coupling signals to and from the metal, receives back responses which appear on the oscillograph in wave form. By reading the oscillograph patterns, flaws in the laminate can be identified.

Announcing New SEIBERT

TOOL CONTROL SYSTEM

Tool Board, Cyclometers, Pre-Setting Gages
Individually Designed to Suit Your Needs

View of typical 9-section unit equipped with pre-setting gages. All units built under licensee patent #2679038.

Now, from Seibert, you can obtain tool control boards that are individually designed to suit your production requirements. Panels are subdivided into sections for each type of tool, and divisions are arranged as required with space for two sets of tools for each job. Tool panels and benches are available in 3, 6, 9 or 12-foot lengths. In addition, you can now obtain from Seibert pre-setting gages of all types and also optional equipment such as plastic cyclometer covers with locks, drawers, shelves, etc., to suit your specific needs.

INCREASES PRODUCTION EFFICIENCY

Tool Control Boards are a tested and proven method of increasing the efficiency of production machine tools. They provide a system of scheduling tool changes according to pre-determined efficiency standards. You cut down-time, insure longer tool life, reduce tool breakage, and lower scrap losses.

PRODUCTION ADVANTAGES

- Reduces down-time, provides an efficient system of programming tool changes.
- Automatically controls machining operations; provides visual record of used life of each tool.
- Assures more efficient use of tools, reduces breakage and scrap losses.
- Provides storage and complete facilities for pre-setting tools at the machine.

Write for Additional Data

Get the complete story on new Seibert Control System. Specify circular T-10, or ask a Seibert Sales Engineer to survey your requirements.

SEIBERT & SONS, INC. CHENOA, ILLINOIS

Quality MULTIPLE DRILL SPINDLES AND PRODUCTION TOOLS

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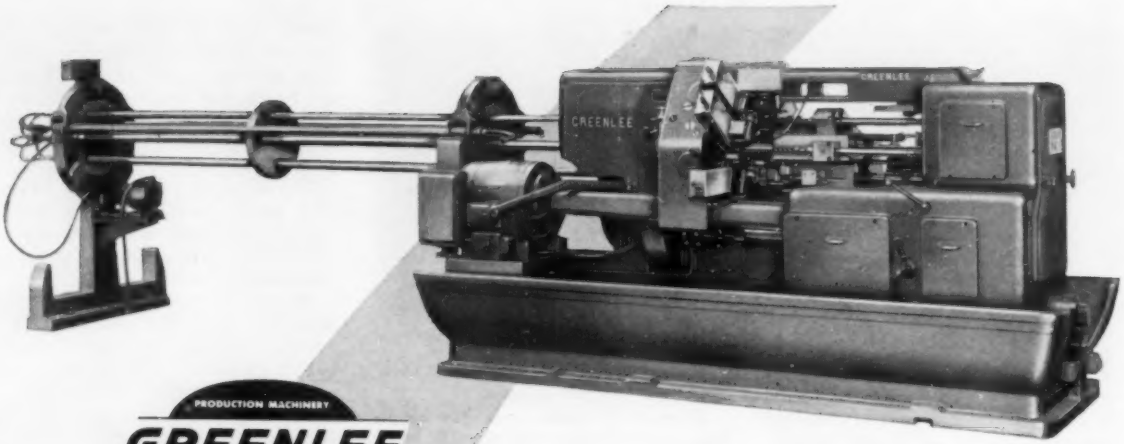
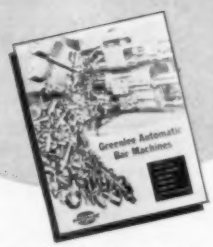


PRODUCTION MACHINERY
GREENLEE

AIR-FEED AUTOMATIC

1. **Permits Greater Job Versatility**
2. **Easily Adapted to Multiple Feedouts**
3. **Provides Longer Stock Feedout**
4. **Eliminates Stock Scoring**
5. **Reduces Stock Reel Noise**
6. **Eliminates Stock Pushers**
7. **Eliminates Feedout Cams**



Write today for Catalog A-405, or better still, have the Greenlee man call and show you the way to more profitable production with this air-feed automatic bar machine.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

GREENLEE BROS. & CO.

PRODUCTION MACHINERY
GREENLEE

1989 MASON AVE.
Rockford, Illinois

FIELD notes

SAE Plans Drafting Manual to Advance Standardization

Plans to produce and publish a drafting manual combining the best and most widely accepted drafting practices in the aeronautic and automotive industries are announced by the Society of Automotive Engineers. By establishing standard drafting terminology and techniques, the society points out that much clearer and less costly communications between engineers will be made possible. It is anticipated that agreement of the ground vehicle and aircraft industries on a single set of drafting standards will be an important step towards national and international unification of drafting practices.

Among projects on the SAE joint Aero-auto drawing standards committee agenda are: improvement of geometric and positional tolerancing standards; simplification of drafting practices; investigation of the trend to eliminate specifying how to process a product on engineering drawings so as to alloy maximum flexibility in use of methods and equipment during manufacture; encouragement in use of decimal dimensioning; standardization in the method of specifying screw threads; development of new drafting techniques for use in preparing drawings that are intended to be reduced in size; and development of a standard method to specify on engineering drawings how to control free state variations in the shape of sheet metal parts.

A library devoted exclusively to solar energy is now operating at the headquarters of the Association for Applied Solar Energy, 204 Heard Bldg., Phoenix. The collection contains more than 2500 references in the form of technical papers, articles and patents, plus the few books which exist at present on the subject.

v v v

To help meet the need for increasing effectiveness of teaching in the fields of science and mathematics in secondary schools, General Dynamics Corp. has launched a program for assistance to teachers in those particular fields. In the Rochester area, the company has set aside $2,000 fund to be administered by its Stromberg-Carlson Div. The fund will be used to give assistance to five outstanding science and mathematics teachers in the central western zone of New York state who wish to enroll in an approved summer educational program.

v v v

Norton Co. has initiated an educational assistance program which recognizes the interest of employees who take additional courses of evening study to provide themselves with useful background for present jobs or preparation for future responsibilities. Under the plan, effective September 1, the company will refund 50 percent of the tuition, registration and laboratory fees up to a maximum of $200 to any employee during a twelve-month period. To qualify, the student must complete his course with a passing grade. Courses, too, must be given in an accredited school, college or other educational institution approved by the Employee Educational Assistance committee.

expansions

Kennametal Inc. has purchased a 1200-acre tract of land near Latrobe, Pa. for expansion of manufacturing facilities and to permit further decentralization to minimize possibility of damage from future disasters. The new unit is expected to be in production by the end of this year.

v v v

Additional facilities will be constructed by The Cincinnati Shaper Co. at its Whitewater shop on Kilby Rd. in western Hamilton County. Construction of the additional manufacturing, administration and engineering building will be completed early in 1958, and will add approximately 180,000 sq ft to the shop. Cincinnati Shaper then will consolidate all of its operations at the Whitewater location.

v v v

More than $1-million will be spent on an expansion program for the manufacturing facilities at the East Pittsburgh plant by Westinghouse Electric Corp. It will involve the plant's transportation and generator division, and will be handled as two projects. The first, already under way, consists of installing new equipment and rearranging facilities. The second project will provide additional capacity for production of large generators for electric utility customers.

v v v

Broad scale national expansion is under way by Pioneer Engineering and Manufacturing Co. which revealed it already had established branches in Dayton, Ohio, Alexandria, Va., and Toronto, Canada. The Dayton Div. of Pioneer is located at 228 Leo St., Pioneer Engineering & Mfg. Co. of Va., Inc., is at 100 King St. in Alexandria. Address of the Canadian affiliate, Pioneer Design Co. is 9 Arnold St., Toronto. Coordination of engineering work at all branches is under S. Paul Burns who has been named chief engineer of the organization.

v v v

Plant facilities of Valenite Metals Corp. are being expanded to triple present size. According to plan, completion is expected by this fall.

v v v

Major expansion at its principal manufacturing plant in Bennington, Vt., has been announced by Bijur Lubricating Corp. Scheduled to be completed about October 1, it will provide additional space for new automatic machine tools and for handling increased production requirements.

v v v

Construction has begun on an addition which will double present plant capacity of Formsprag Co. The building, which is to be completed by September 15, is located with present facilities on Hoover Rd., Van Dyke, Mich.

v v v

Completion of its Mechanical Power Transmission warehousing expansion program has been announced by Worthington Corp. The program, which has been under expansion for more than a year, is designed to keep mechanical power transmission stock flowing smoothly from the factory to various distribution points in the nation. Ware-

house locations are broken into three areas—East Coast-Mississippi, Mid-Continent, and West Coast-Rocky Mountain. From these general locations, the system is broken further into warehouses serving smaller areas.

corporate changes

Electronic Industries, Inc. has been acquired by Consolidated Electrodynamics Corp. and will become a wholly owned Consolidated subsidiary but will retain its present name and activity. Hugh F. Colvin, CEC president, will be president of the new subsidiary, and George B. Clark will serve as vice-president and general manager.

v v v

According to announcement from E. W. Bliss Co., that firm has acquired ownership of John Robertson Co., Inc. and will operate it as a wholly owned subsidiary. The step will add a new product group to the Bliss line of metalworking equipment. Robertson makes extrusion lead presses and related equipment.

Compare this latest jig borer for capacity accuracy speed!

New KNIGHT'S Jigmaster

Last word in medium size jig borers —unequalled for extreme accuracy, capacity, increased output.

The totally enclosed spindle and quill mounted on super-precision ball bearings, with quill moving in a solid bearing . . . the extra-wide base and reinforced column, both cast as a single unit . . . the wider bearing surfaces . . . all contribute to the Jigmaster's exceptional rigidity and accuracy.

Any one of three table and saddle locating devices may be used for hole location. All machine controls can be operated from a single convenient location.

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SPECIFICATIONS

Table Size	18" x 24"
Table Travel—Longitudinal	20"
—Cross	15"
Vertical Capacity	23"
Throat	20"
Weight	7500 Lbs.

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W. B. KNIGHT MACHINERY COMPANY
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To reflect the wider range of the company's activities, the name of Austenal Laboratories, Inc. has been changed to Austenal, Inc.

v v v

Houdaille Industries Inc. has acquired assets of Wales-Strippit Corp. as part of a program to diversify its field of operation.

v v v

Two manufacturers in the metalworking industry have merged to form Swift-Ohio Corp. Companys involved were Swift Electric Welder Co., manufacturers of electric welding machines, and Ohio Machine Tool Co., makers of heavy machinery. According to the announcement, the combined engineering and production facilities will enable the new organization to offer a variety of combined welding, machining and assembly equipment to industry.

v v v

Hydraulic Press Mfg. Co. has been merged into the Koehring Co. permitting Koehring to further diversify markets for its products. No changes in management or policies of H-P-M are contemplated.

new facilities

Dedication ceremonies are scheduled for September 18 for the new Parma, Ohio research laboratories of National Carbon Co., a division of Union Carbide and Carbon Corp. Designed primarily for basic research in chemical and solid state physics, this multi-million dollar laboratory is already in operation by research scientists studying ways to improve existing materials and methods to create new ones for metal, electronic, power, chemical and electrochemical industries. The laboratory, situated near the center of a 126-acre plot on Snow Rd. in suburban Cleveland, contains approximately 175,000 sq ft floor space. Designed for flexibility, with provisions for expansion, the main laboratory building houses 158 individual research units. These are fully equipped with usual service lines as well as unusual features such as lines distributing various rare gases. Supplementing this facility are adjacent wings housing the chemical engineering and laboratory furnace areas, machine shop and employee service areas, plus administrative, clerical and business offices.

v v v

Temco Aircraft Corp. plans to build a $1-million engineering center adjacent to its Garland plant. Upon completion of the center, all Temco engineering functions and personnel

except project groups and others working in direct support of production contracts will be moved to Garland. The unit will provide facilities for administration, design, ultra-modern laboratories, as well as a bay area with a 30-ft overhead clearance for experimental work, structural testing and prototyping. The entire structure is designed to permit rapid expansion of any of the functional areas. Initially it will provide sufficient space for a professional force of about 900 engineers.

v v v

Thor Power Tool Co. has begun construction of a building to house its Indianapolis branch operation at 1489 N. Harding St. A complete factory service station will occupy a major portion of the new structure, which will be ready for occupancy this fall.

Earlier, Thor announced that its Milwaukee branch office had been moved to a new building at 3911 W. Greenfield Ave. The new facility provides about twice the floor space available at the former headquarters, permitting Thor to expand its repair and service areas.

v v v

Modern foundry facilities for manufacture of hard-facing alloys has been completed by Wall Colmonoy Corp. The new structure, which contains complete line of molding equipment, electric melting furnaces and production machinery, provides room to complete its program for consolidation of its Detroit operations including sales, service, research and development and manufacturing under one roof.

v v v

Warehousing of titanium metal was initiated by Titanium Metals Corp. of America which opened a facility at 6465 Corvette St., Los Angeles, Calif. It is stocked with types and sizes of metal most popular with West Coast airframe and missile fabricators.

moves

Metal Powder Assn. has announced its move to new offices at 130 W. 42nd St., New York 36, N.Y. At the same time, the organization revealed appointment of Kempton H. Roll as its first full-time executive secretary and treasurer.

v v v

Research Div. of Marquardt Aircraft Co. has moved into the first unit of what eventually will be the Marquardt Research Center. Plans call for the completed center to include a research headquarters building, experimental and model shop, materials and process laboratory, and a research testing facility. The presently occupied area is the research headquarters building. Later this year construction will begin on the first phase of the research testing unit.

v v v

The Flodar Corp. has moved to larger quarters at 16911 St. Clair Ave. in Cleveland. This plant, which provides the third expansion for the company in the past 11 years, has more than seven times the former floor space.

consolidations

Consolidation of its facilities at Springfield, Mass. has been completed by Titeflex, Inc. at a cost of $1½-million. This permits the company to take advantage of the economies and efficiency derived from operation of one plant, according to company announcement. The Springfield plant was selected for the consolidation because of its layout for efficient manufacturing, and because it afforded the space in which to expand. Approximately 16 acres remain for further contemplated expansion.

v v v

To provide simplified operation and coordinate two local units more closely, Detroit Gear Div. has been added to the Long Mfg. Div. to be operated as a separate manufacturing unit under the general management of Long. All Detroit Gear manufacturing activities will be consolidated at the Detroit Gear-Kercheval plant and will be identified as the Detroit Gear Plant of Long Mfg. Div.

new branches

A factory branch for Wagner Bros., Inc. has been established in Grand Rapids, Mich. to service that area. It will house laboratory, warehousing and technical service facilities. Address of the branch is 2417 Eastern Ave., S.E.

v v v

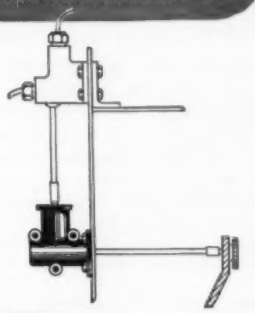
New engineering offices for Harvey Aluminum have been opened in Atlanta and Detroit. They are located at 1430 Peachtree St., N.W., Atlanta and at 505 Park Ave., Detroit.

v v v

A. Milne & Co. has opened a branch office at 1635 Gent Ave., Indianapolis, Ind. Manager in charge of the new facility is C. A. (Curt) Payntor.

ANGLgear

simplifies the problem of 90° drive



There's an ANGLgear to solve virtually any 90° power take-off problem on either manual or power-operated equipment.

Replace bulky chains and sprockets with ANGLgear, the modern right-angle power take-off. High capacity ANGLgear requires little space and can be mounted four different ways. Thus ANGLgear is easily incorporated in your power transmission system.

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Why pay for expensive custom-made drives? Standardized ANGLgear is available immediately from stock in 3 sizes and 12 models, offering you 1-1 or 2-1 gear ratios and 2- or 3-way shaft extensions. See our literature in Sweet's product design file; then contact your local distributor or write us for information.

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INDICATE A-9-189

TRADE literature

For Free Booklets and Catalogs — Convenient Request Card on Page 169

Rotary Grinders

Company's Type TR twin rotary grinders described in detail in Catalog TR56; well illustrated with photographs to show important features of design and construction; includes specifications. Thompson Grinder Co., Springfield, Ohio. **L-9-1**

Motors

Bulletin No. 1878 presents line of motors including open-type Uniclosed designs, totally enclosed, and explosion proof types, Varidrives, Syncrogears, and right angle worm gear models as well as vertical motors and Verticlosed hollowshaft types; illustrated. U. S. Electrical Motors Inc., Box 2058, Los Angeles 54, Calif. **L-9-2**

Cap Screw Tightening

"Cap Screws . . . How Much Torque?" discusses this subject and explains causes of fatigue failure of screws; includes tables of recommended torques for company's own cap screws and place bolts. The Cleveland Cap Screw Co., Box 786, 2917 E. 79th St., Cleveland 4, Ohio. **L-9-3**

Drafting

First section of this 56-page booklet, "Standard and Simplified Drafting Practices," contains paper by AMF standards administrator Jay H. Bergen, on the subject; second section covers details of company's standards on drafting room practice and simplified drafting; final section also includes list of rules governing such work; drawings serve to illustrate various points of discussion. Request only on company letterhead directly to Public Relations Dept., American Machine & Foundry Co., 261 Madison Ave., New York 16, N. Y.

Installation Accessories

Sixteen-page Catalog No. 17-E deals with installation accessories for lubrication, hydraulic, steam, liquid and air applications; includes complete information, specifications and prices on items including adapters, couplings, extension nipples, hose clamps, snubber tools, pipe fittings, etc. J. N. Fauver Co., Inc., 51 W. Hancock, Detroit 1, Mich. **L-9-4**

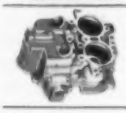
Powder Metallurgy Products

Illustrated E-56 Engineering Manual contains complete details about Oilite products including data on properties of Oilite materials and listing Brinell and Rockwell ratings; the 52-page manual contains a 12-page insert which lists standard Oilite sleeve, flange and thrust bearings, cored, solid bar and plate stock. Amplex Div., Chrysler Corp., Detroit 31, Mich. **L-9-5**

Aluminum

Monthly 32 to 36 page publication, "Reynolds Aluminum Digest," designed to provide up-to-date information on developments in the aluminum field, plus summary of related current events, statistics on the aluminum industry and patent listings. Available only to those requesting on company letterhead to Desk, ES, Reynolds Metals Co., 2500 S. Third St., Louisville 1, Ky.

NEED LOW-COST, PRODUCTION OF

Part	No. of Stations	Operations		Production
Cover Cylinder Front	4	19 drilling 3 boring 6 chamfering 6 tapping 1 reaming	TOTAL 35	137 pcs./hr.
 Carburetor Main Body	6	15 drilling 3 counterboring 1 tapping 1 spotfacing	TOTAL 20	375 pcs./hr.
Water Pump Cover	6	12 drilling 2 milling 3 boring 2 chamfering 4 reaming 1 counterbore	TOTAL 24	177 pcs./hr.
Throttle Body for Four Barrel Carburetor	6	7 drilling 2 countersinking 3 spotfacing 6 reaming 1 tapping 1 milling 1 chamfering	TOTAL 21	375 pcs./hr.

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These precision operations are performed on Morris Unit-Type Production Machines . . . at only pennies per part! Morris Custom Engineering Service develops the equivalent of a "Special Machine". . . using standard basic and automatic drilling units . . . at a fraction of the usual "Special Machine" price!

This fast, accurate, production method may be applicable to your products. Write for information, or outline your production problem for analysis by Morris engineers.

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Moly Iron Castings

Series of 4-page illustrated leaflets entitled "Moly Iron Castings" present technical information and case histories on use of molybdenum as an alloying element in gray iron castings; illustrated by photos, charts and graphs. Climax Molybdenum Co., Dept. L, 500 Fifth Ave., New York 36, N. Y. **L-9-6**

Bushings

Illustrated 6-page Bulletin 56 provides information on standard bushing design, special bushings, lubrication and choice of materials offered as aid in selection of guide pin bushings for die sets; lists standard bushing sizes carried in stock with complete dimensions. Detroit Die Set Corp., 2895 W. Grand Blvd., Detroit 2, Mich. **L-9-7**

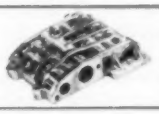
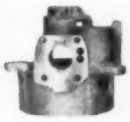
Threading Heads

Heat treated threading die heads presented in 28-page Bulletin F-90-3; close-up photos used to show various details of design and construction; discusses advantages of line, important design features, special attachments available; includes tables of dimensions and specifications. Landis Machine Co., Waynesboro, Pa. **L-9-8**

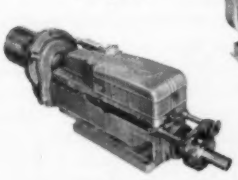
Press Brakes

Construction details of Steelweld Press brakes described and illustrated in revised Catalog No. 2010-J; includes dimensions and specifications for entire standard line ranging in bending capacity to 14 ft x ¾ in. mild steel. The Cleveland Crane & Engineering Co., Wickliffe, Ohio. **L-9-9**

HIGH SPEED PARTS LIKE THESE?

Part	No. of Stations	Operations		Production
Refrigeration Compressor Crankshaft	12	10 drilling 1 gun drilling 1 chamfering 2 milling	TOTAL 14	121 pcs./hr.
 Automatic Transmission Control Valve Upper Body	8	4 drilling 3 tapping 3 reaming	TOTAL 10	188 pcs./hr.
Air Horn Four Barrel Carburetor	6	18 drilling 2 reaming 1 countersinking 1 spotfacing 1 tapping	TOTAL 23	375 pcs./hr.
 Refrigeration Compressor Cylinder Housing	18	4 milling 19 drilling 11 burring 4 counterboring 3 reaming 3 spotfacing 10 tapping 3 boring 1 chamfering	TOTAL 58	120 pcs./hr.

MORRIS Automatic Drilling Units



AIR-OIL-MATIC

CAM-MATIC

MORRIS High Production Machine 18 station

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Sheaves

Complete line of Ful-Grip Q-D, standard multi-V and special made-to-order sheaves presented in informative, illustrated catalog; includes practical information on handling of sheaves, describes construction, and gives installation information; tables and charts list data on dimensions; also includes corresponding data on required bushings. Maurey Mfg. Co., 2915 S. Wabash Ave., Chicago 16, Ill. **L-9-10**

Cemented Carbide

Forty-four page brochure, B-222, "Designing with Kennametal," provides mechanical information necessary to engineers responsible for designing parts calling for use of Kennametal or Kentanium; numerous drawings serve to illustrate various points. Kennametal Inc., Latrobe, Pa. **L-9-11**

Air Control Valves

Line of 2, 3 and 4-way air control valves for high or low pressure installations covered in illustrated 72-page catalog; also presents information on single and double-acting cylinders for air or hydraulic use and strainers for pipeline protection; includes information on main features of each valve, cylinder or strainer, application data, dimensions and specifications. Airmatic Valve Inc., 7317 Associate Ave., Cleveland 9, Ohio. **L-9-12**

Heat Treating

Solution to variety of heat treat problems in commercial heat treat shop discussed in Vol. 7, No. 1 of company publication "Heat Treat Review;" other articles included in issue deal with various phases of heat treating. Surface Combustion Corp., Toledo 1, Ohio. **L-9-13**

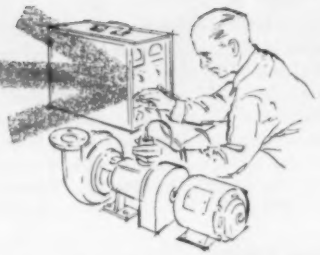
Roll Grinders

Type 30 roll grinders, available in 36, 44, 50 and 60 in. swings and center lengths from 10 to 24 ft, discussed in extensively illustrated 26-page Catalog V-56; includes specifications and descriptions of standard and extra equipment. Landis Tool Co., Waynesboro, Pa. **L-9-14**

Hydraulic Cylinders

Class 4 hydraulic cylinders for 2000 psi service are described in 12-page Catalog 104; includes detailed engineering and dimensional data in easy-to-use form; shows cross-sections of parts and special features. Galland-Henning Nopak Div., 2750AS. 31st St., Milwaukee 46, Wis. **L-9-15**

3



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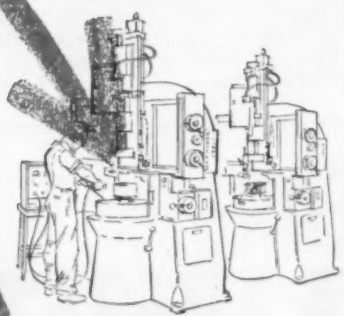

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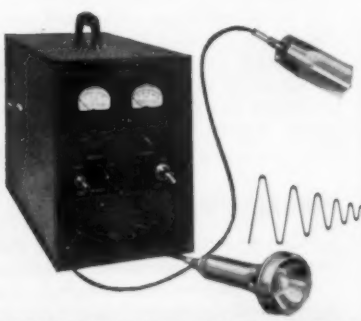

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Diamond Products

Informative industrial diamond products catalog No. 5 provides help in selecting correct diamond tool for specific job; includes concise descriptions plus photos and tables on diamond dressing and trueing tools, cutting and boring tools, powder, compound and plated mandrels. Diamond Tool Research Co., Inc., 380 Second Ave., New York 10, N. Y. **L-9-16**

Power Transmission Equipment

Full line of power transmission equipment including flexible couplings, variable speed pulleys and transmissions, universal joints and motor bases described and illustrated in 12-page technical brochure; discusses operating data, horsepower ratings, sizes and types for various applications. Lovejoy Flexible Coupling Co., Dept. TED, 4800 W. Lake St., Chicago 44, Ill. **L-9-17**

Aluminum Casting

Extensive information on all phases of aluminum casting presented in 388-page book designed primarily for foundrymen interested in using this metal; also useful to fabricators and designers seeking comparative information concerning application of aluminum castings to specific products; progressive foundry practices are fully treated with analysis of aluminum casting alloys and their characteristics; discusses comparative and descriptive material on various methods of casting; also covers such subjects as designing for aluminum castings, heat treating, inspection, finishes and salvage. Request only on company letterhead to Technical Editor, Dept. A-20, Kaiser Aluminum & Chemical Sales, Inc., 919 N. Michigan Ave., Chicago, Ill.

Silicons

Eight-page brochure features R/M silicone rubber products and silicone coated cloths; tells what the substance is, outlines its data and properties and discusses its advantages and limitations. Raybestos-Manhattan, Inc., Passaic, N. J. **L-9-18**

Metal Marking

Complete line of metal marking machines and tools presented in extensively illustrated 36-page catalog issued to celebrate the company's 50th anniversary. Includes basic technical information on the subject, as well as details on various machines in the line, dimensions and specifications; also extensively illustrates various marking applications. Richard H. Gunther, Noble & Westbrook Mfg. Co., Westbrook St., East Hartford 8, Conn. **L-9-19**

Steel Tubing

Bulletin 12-6 organized as guide to buyers and designers in selecting specially processed steel tubing and cold finished steel bars for hydraulic cylinders and fluid lines; provides engineering data on both Rockrite cylinder tubing and Ryerson hydraulic fluid line tubing, plus other tubing; includes information on tolerances, mechanical properties and bursting pressures. Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill. **L-9-20**

Switches

Two brochures present information on two general types of electromechanical switches—Bulletin T5001 on automatic stepping switches, and Bulletin T5002 on key switches for manual operation; include discussions of important features, uses and function, plus specifications and ordering information; well illustrated with diagrams and drawings. Telephone Div., Stromberg-Carlson Co., Rochester 3, N. Y. **L-9-21**

Tape Recording System

Bulletin 1561 B discusses design details, uses and advantages of Datatape magnetic tape recording and playback system for use in test and instrumentation field; photos show various units in the system. Consolidated Electrodynamics Corp., 300 N. Sierra Madre Villa, Pasadena, Calif. **L-9-22**

Forgings

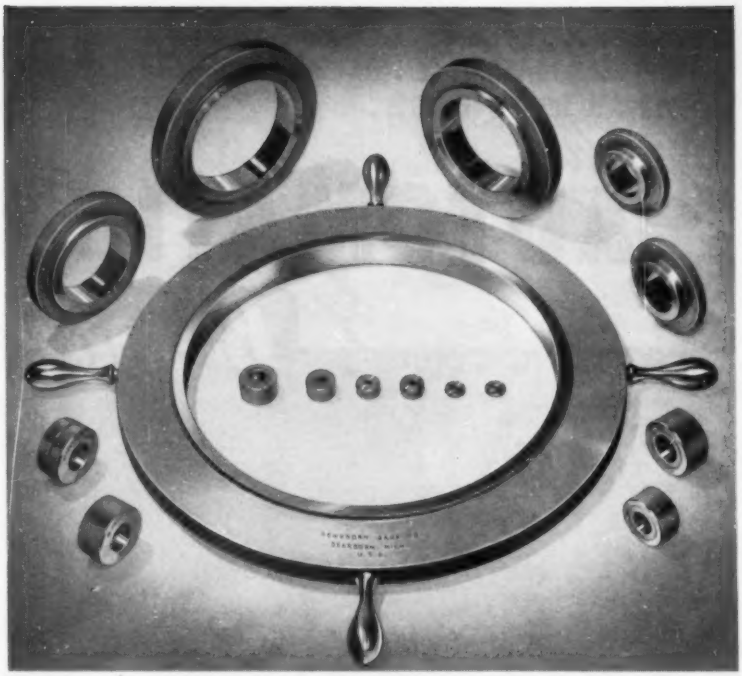
Illustrated 12-page booklet on aluminum, brass and copper forgings explains and emphasizes advantages of die-pressed forgings; charts enumerate, physical, mechanical and fabricating properties of various copper and aluminum base alloys. Electric Welded Steel Tubing & Forgings, Rome Mfg. Co. Div., Revere Copper and Brass Inc., P.O. Box 111, Rome, N. Y. **L-9-23**

Descaling Machines

Extensively illustrated, 16-page Brochure No. 608 describes equipment for continuous, mechanical descaling by shot blasting; photos and drawings show details of construction, actual installations and specifications. Pangborn Corp., Hagerstown, Md. **L-9-25**

Extrusion Presses

Complete line of presses for extrusion of ferrous and nonferrous metals illustrated in 8-page Bulletin 14.17; shows details of basic design features and gives concise explanation of advantages of each. Lake Erie Engineering Corp., Box 68, Kenmore Station, Buffalo 17, N. Y. **L-9-25**



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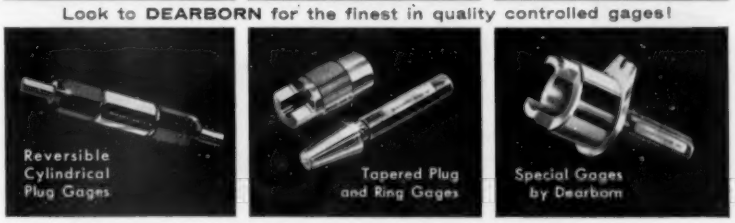

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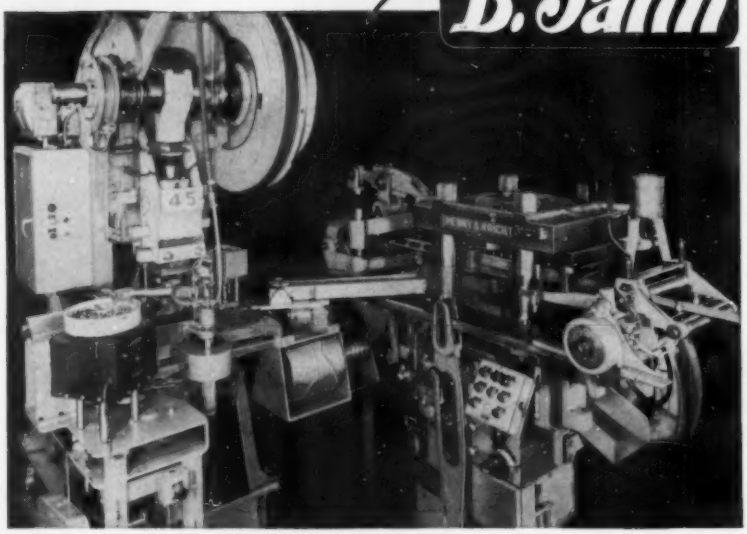

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Filters

Two revised catalogs include up-to-date engineering data and dimensional charts for all sizes of both sump type and line type Synclinal filters. Catalog No. 107 covers filters for hydraulic oils, coolants and lubricants, while Catalog No. 301 presents data on water filters. A new catalog, No. 200, contains complete data on filters for fire resistant hydraulic fluids. Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill. **L-9-26**

Hydraulic Drives

Eight-page bulletin 15011 entitled "Industrial Rotating Hydraulic Drives," presents reprint of talk by Milton G. Malmquist of Minnesota Mining and Manufacturing covering automation and its application in performing operations on continuous webs; discusses problems including tension, speed, control, acceleration, deceleration, torque and synchronizing. The Oilgear Co., 1599C W. Pierce St., Milwaukee 4, Wis. **L-9-27**

Blast Cleaning

Eight-page Bulletin No. 607 describes the En-2 blast cleaning cabinet for small or intermittent work; extensively illustrated by photos and drawings to show details; includes dimension and specification tables. Pangborn Corp., Hagerstown, Md. **L-9-28**

Directional Control Valves

Three and four-way directional control valves for fluid power systems up to 3000 psi described in 16-page Bulletin 80300; includes details of body constructions and functions of standard and special plungers; extensively illustrated by photos, drawings and charts. Bulletin 80200 gives similar information on company's two-way directional control valves. The Oilgear Co., 1599C W. Pierce St., Milwaukee 4, Wis. **L-9-29**

Lathes

Sixty-six models of screw cutting and turret lathes described in 24-page Lathe-Shaper-Accessories Catalog; includes full specifications, discussions of special features and numerous illustrations. Logan Engineering Co., Lathe Div., 4901 W. Lawrence Ave., Chicago 30, Ill. **L-9-30**

Dryers

High-speed low-temperature dryers for continuous drying processes discussed in Bulletin K-156, "Engineered Drying." Air Conditioning and Drying Div., Surface Combustion Corp., Toledo 1, Ohio. **L-9-31**

who's meeting and where

Sept. 7-9. METAL POWDER ASSN. Fall Meeting, The Homestead, Hot Springs, Va. Get full particulars from association office, 420 Lexington Ave., New York 17, N.Y.

Sept. 9-12. AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. Fall meeting, William Penn Hotel, Pittsburgh, Pa. Direct inquiries to 25 W. 45th St., New York 36, N. Y.

Sept. 9-12. NATIONAL METAL TRADES ASSN. Eastern plant management conference, Essex-Sussex Hotel, Spring Lake, N. J. Association office, 122 S. Michigan Ave., Chicago 3, Ill., can supply other facts.

Sept. 10-15. INVESTMENT CASTING INSTITUTE. Intensive 6-day course, University of Michigan. For more data, write to institute office, 27 E. Monroe St., Chicago 3, Ill.

Sept. 11. CUTTING TOOL MANUFACTURERS ASSN. Fall meeting, Lochmoor Club, Detroit, Mich. Write to association office, 416 Penobscot Bldg., Detroit 26, Mich. for details.

Sept. 11-13. AMERICAN DIE CASTING INSTITUTE. Annual meeting, Edgewater Beach Hotel, Chicago, Ill. Write for other data to institute office, 366 Madison Ave., New York 17, N. Y.

Sept. 11-14. PACKAGING MACHINERY MANUFACTURERS INSTITUTE. Packaging machinery and materials exposition, Public Auditorium, Cleveland, Ohio. For further information, contact Hanson & Shea Inc., One Gateway Center, Pittsburgh 22, Pa.

Sept. 16-21. AMERICAN CHEMICAL SOCIETY. Annual meeting, Convention Hall, Atlantic City, N. J. Society office, 1155 16th St., N. W., Washington 6, D. C., will provide further data.

Sept. 16-22. AMERICAN SOCIETY FOR TESTING MATERIALS. 2nd Pacific area national meeting and apparatus exhibit, Hotel Statler, Los Angeles, Calif. Details may be had from society office, 1916 Race St., Philadelphia 3, Pa.

Sept. 17-21. INSTRUMENT SOCIETY OF AMERICA. 11th annual instrument-automation conference and exhibit, New York Coliseum, New York, N. Y. Direct inquiries to society office, 1319 Allegheny Ave., Pittsburgh, Pa.

Sept. 19-21. PORCELAIN ENAMEL INSTITUTE, INC. 25th annual meeting, The Broadmoor, Colorado Springs, Colo. Institute headquarters, 1145 Nineteenth St., N. W., Washington 6, D. C., can provide other data.

Sept. 24-25. MATERIAL HANDLING INSTITUTE, INC. Fall meeting, Greenbrier, White Sulphur Springs, W. Va. For more facts write institute office, One Gateway Center, Pittsburgh 22, Pa.

Sept. 24-25. STEEL FOUNDERS' SOCIETY OF AMERICA. Fall meeting, The Greenbrier, White Sulphur Springs, W. Va. Request more information from society office, 606 Terminal Tower, Cleveland 13, Ohio.

Sept. 24-28. ATOMIC INDUSTRIAL FORUM, INC. 1956 Trade Fair of the atomic industry, Navy Pier, Chicago, Ill. Forum conference on "Management and Technology for the Atomic Industry" to be held Sept. 25-27, Morrison Hotel, Chicago. Request details from Forum office, 3 E. 54th St., New York, N. Y.

Sept. 25-28. ASSOCIATION OF IRON AND

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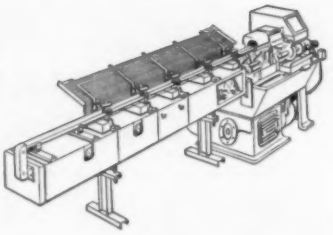

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STEEL ENGINEERS. Annual meeting and exposition, Public auditorium, Cleveland, Ohio. Write for details to association office, 1010 Empire Bldg., Pittsburgh, Pa.

Oct. 1-3. NATIONAL ELECTRONICS CONFERENCE INC. Annual meeting and exhibit, Sherman Hotel, Chicago, Ill. Details are available from conference headquarters, 84 E. Randolph St., Chicago 1, Ill.

Oct. 1-5. AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Fall general meeting, Morrison Hotel, Chicago, Ill. Write for more information to institute office, 33 W. 39th St., New York 18, N. Y.

Oct. 2-6. SOCIETY OF AUTOMOTIVE ENGINEERS INC. National aeronautic meeting, aircraft production forum and aircraft engineering display, Hotel Statler, Los Angeles, Calif. More information may be had from society office, 29 W. 39th St., New York 18, N. Y.

Oct. 3-5. STANDARDS ENGINEERS SOCIETY. Fifth annual meeting on "Standards—Guides for Tomorrow," Hotel Willard, Washington, D. C. Write to the society, P.O. Box 281, Camden 1, N. J. for more information.

Oct. 8-10. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Lubrication conference, Chalfonte-Haddon Hall, Atlantic City, N. J. Society office, 29 W. 39th St., can supply other information.

Oct. 8-12. AMERICAN SOCIETY FOR METALS. National metal congress and exposition, Public Auditorium, Cleveland, Ohio. Obtain further facts from society headquarters, 7301 Euclid Ave., Cleveland 3, Ohio.

Oct. 8-12. AMERICAN WELDING SOCIETY. Fall technical meeting, Hotel Cleveland, Cleveland, Ohio. Write for information to society office, 33 W. 39th St., New York 18, N. Y.

Oct. 10-11. THE MATERIAL HANDLING INSTITUTE, INC. Fall meeting, The Traymore Hotel, Atlantic City, N. J. For details contact institute office, One Gateway Center, Pittsburgh 22, Pa.

Oct. 11-12. AMERICAN SOCIETY FOR QUALITY CONTROL. 11th midwest quality control conference, sponsored in cooperation with the University of Minnesota and the Minneapolis and St. Paul Chambers of Commerce, Hotel Leamington, Minneapolis, Minn. Request additional conference information from conference secretary, Robert Keane, P. O. Box #4337, Minneapolis 18, Minn.

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INDICATE A-9-197-1

abstracts of FOREIGN LITERATURE

By M. Krousenberg
Consulting Engineer

Surface Finish Inspection

Instruments available in Germany for measuring surface finish are surveyed in *Overseas Post* of April, 1956 by M. Duehmke. Need for high production at low cost demands inspection and evaluation of machined surfaces with the aid of instruments. Often a qualitative determination of roughness is considered sufficient and microscopes are available with up to 1000 times magnification.

One instrument for surface quality examination is based on principle of interference of visible light. Manufactured by H. Schneider, it uses a beam of parallel light, which is thrown upon the test surface and reflected. That portion which is reflected is used for evaluation of surface quality.

Inspection of bores is possible with an instrument developed by S. Werth, which may also be used for inspection of grooves, shoulders, etc.

When an optical flat is pressed against a rough surface and its illuminated underside is microscopically inspected, the total reflection is disturbed wherever the two surfaces contact. The ratio of the width of the interference fringes to the total length inspected, called bearing portion, defines roughness and can be tested by an instrument made by Kordt & Co. Other interference testers described are made by Hahn & Kolb, and Askania Works.

Improved Milling Cutters

Improvements in milling cutters in Russia have been described in the French magazine *La Machine Moderne*, May, 1956, by W. N. Worobieff and N. G. Neuweiler. The authors indicate that the tool geometry of milling cutters, used in the manufacture of turbines, has been changed substantially. Contour of the teeth corresponds to a parabola. The strength of the teeth has been considerably increased in this way, permitting higher feeds and speeds and better chip removal. The teeth have the shape of beams of uniform strength making it

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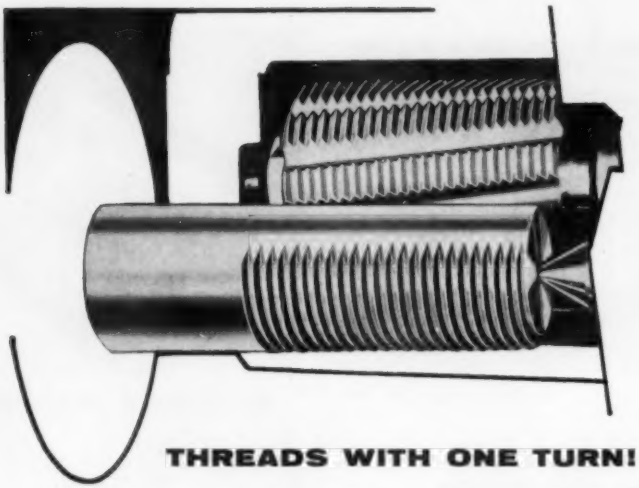

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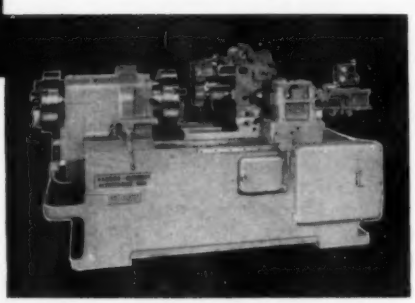
*Available — larger sizes and/or special cycles; automatic loading — rough and finish cycle; extra length beds, oversize swings.



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possible to increase, for example, the height of the teeth from 0.24 to 0.32 inch on a cutter with 6 teeth and 1.6 inch diameter.

On reamers the geometry of the teeth was also modified with negative lead angle eliminated. The new design consists of several cylindrical portions that cut in succession. The cutting speed of the redesigned reamers could be increased to 10.5 sfpm from 7.5 sfpm and the feed to 0.014 inch per revolution from 0.006 ipr.

Additional advantages of the new design are better rigidity of the tools, improved chip removal, and absence of variation in the forces normal to the axis, which are often detrimental to smooth operation of the reamer.

Hungarian Machine Tools

The machine tool industry in Hungary, which has been developed since the war, is on its way to production of special and standard machines to become independent of American and West European supply, according to an article in *Technica* No. 11, May 25, 1956.

An example of the development is given of engine lathes. They are equipped with feed boxes by which the danger of leaving gears in engagement when cutting multiple threads while running the lathe at high spindle speeds is eliminated. Another improvement is an automatic control mechanism with three push buttons for setting the feed for the cutting of 81 different metric or English threads. Radial drills are built in six sizes, indicating that this formerly agricultural country is being industrialized.

Lightweight Design of Machine Tools

An article by W. Frank in the June 1956 edition of *Werkstatt und Betrieb* covers principles of lightweight design of presses, shears and grinding machines. The author indicates that production cost can be reduced by welding machine tools. The ease with which changes can be made is an important advantage. Others are reduction in weight and independence from the limitations of the patterns required for castings.

The article is divided into several sections, including considerations of the work material, preparations for welding, the welding operations, fixture design, testing and welding shop.

Among the testing methods the author discusses testing with magnetic powder, in which the weldments are covered with iron powder mixed with oil and the workpiece is magnetized. Cracks can easily be recognized by the accumulation of particles of the powder. It is, however, necessary to magnetize in two directions perpendicular to each other because, otherwise, cracks running in the same direction as the magnetic flux

would not show up.

Another testing method makes use of supersonic waves and is used in addition to X-ray methods. The latest development is the application of radioactive isotopes for testing weldments. Instruments have been developed screening the isotopes and eliminating any danger associated with the use of radioactive substances. Four different types of isotopes are recommended, namely thalium 170 for thin metal sheets, iridium 192 for steel from 0.2 to 2-inch gage, caesium 137 for steel from 0.24 to 2.8-inch gage and cobalt 60 for heavy plates of 1.6 to 10-inch thickness. The isotopes are placed in a lead ball which must be rotated through 180 deg in order to activate the isotopes. Photographic records can be made of the weldments at several places simultaneously; they are considerably better than records made with X-rays. Numerous practical examples of welded machine tools round out the article.

Galvanization of Screws

Although galvanization of screws has not yet been a complete success, a report on this new development for improving surface finish, reducing friction and corrosion of threads has been published by R. Kellermann and H. Klein in the June 1956 issue of *Werkstattstechnik und Maschinenbau*.

Electroplating of lead screws and other threaded parts is increasing in spite of the difficulties encountered in maintaining tolerances and fits between screw and nut. After discussing the electrochemical process and deriving mathematical formulas for the relationships involved, the authors discuss model tests that were run in order to check the theoretical conclusions.

The first tests showed that deposited metal scaled off when polishing the pieces. It was found necessary to avoid oxidation of the threads before placing them in the bath and it was also necessary to use larger anodes in comparison with the surface of the screws.

Various metals were tried, such as cadmium, copper, chromium, nickel and zinc and various combinations and compositions of baths were used, details of which are given in the article.

Testing of Antifriction Bearings

Instruments are described in an article by E. Landwehr and A. Witte published in No. 17 of *Zeitschrift des Vereins Deutscher Ingenieure* for testing antifriction bearings. The tests cover accuracy of the OD and ID and of other dimensions as well as the performance of the bearings, indicated by absence of run out noise, etc. Pneumatic instruments are discussed and also instruments using plugs, levers and other devices.

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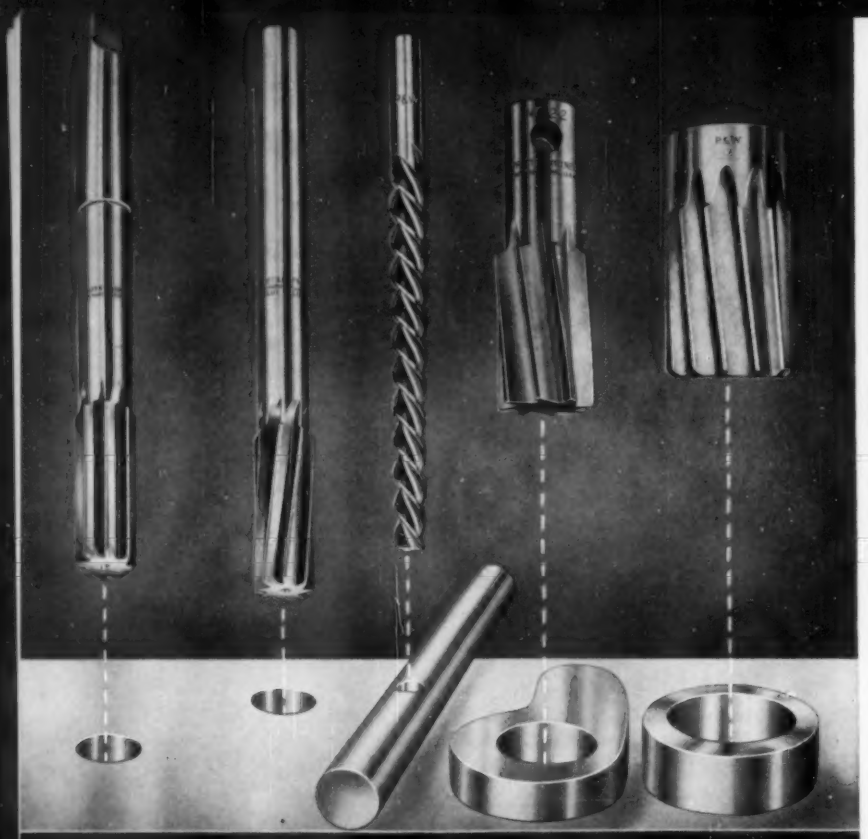

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HANDBOOK PREFERRED CIRCUITS NAVY AERONAUTICAL ELECTRONIC EQUIPMENT —*Prepared by National Bureau of Standards, Department of Commerce for sale by the Superintendent of Documents, U S Government Printing Office, Washington 25, D. C. Price $1.75. 218 pages.*

The purpose of the Preferred Circuits Manual is to encourage better engineering practice in the design of circuits for military electronic equipment. The name "preferred circuit" was chosen rather than "standard circuit," since a circuit cannot become a "standard" until it is widely adopted. Also "preferred" was adopted because the connotation that has been widely established from the several "preferred tube" list is exactly the same as that meant here. The manual may be considered as a compilation of good design practice, not toward the limiting of effort in circuit design, but as a standard against which true progress in circuit design may be measured.

For the equipment producer, standardization of circuitry will result in lower production costs, quicker shifting of equipment from development to production phases, better conservation of scarce engineering manpower, and lower parts inventories. The success of this circuit standardization program depends ultimately upon the active participation of the design engineer and equipment manufacturer in utilizing the circuits, in criticizing material presently in the manual and in submitting improved or additional circuits for inclusion in the manual.

PLASTICS TOOLING—*by Malcolm W. Riley. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $2.50. 136 pages.*

As plastics tooling is still in its infancy as a major production method, a status report is needed to bring one up to date on the resins and methods used

and the major applications of plastics tooling.

This book is a report based on the information that has already been printed and that was gathered by personal interview. What discussion there is on plastics is limited to showing how their composition affects their use in tooling.

SURFACE COATING AND FINISHES—*by Philip L. Gordon and George J. Dolgin. Published by Chemical Publishing Co., Inc., 212 5th Ave., New York 10, N. Y. Price $9. 300 pages.*

This book covers the application of the results of modern research to paint and varnish technology. It contains information on synthetic resins, fast-drying and water-resistant oils and their combination into scientifically formulated varnishes.

The structure, origin, physical and chemical properties and practical value of plastic type substances are presented to benefit students, manufacturers and research workers in the proper application of these synthetics.

Contained also is a glossary of resin trade names.

THE STRAIN GAGE PRIMER—*by C. C. Perry and H. R. Lissner. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $6. 298 pages.*

This book is a practical guide to best methods of using strain gages in stress analysis. All practical areas of the subject are covered, from picking the right gage for a job, through cementing and damage-proofing the gages; selecting instruments and interpreting the strain data in terms of important stresses.

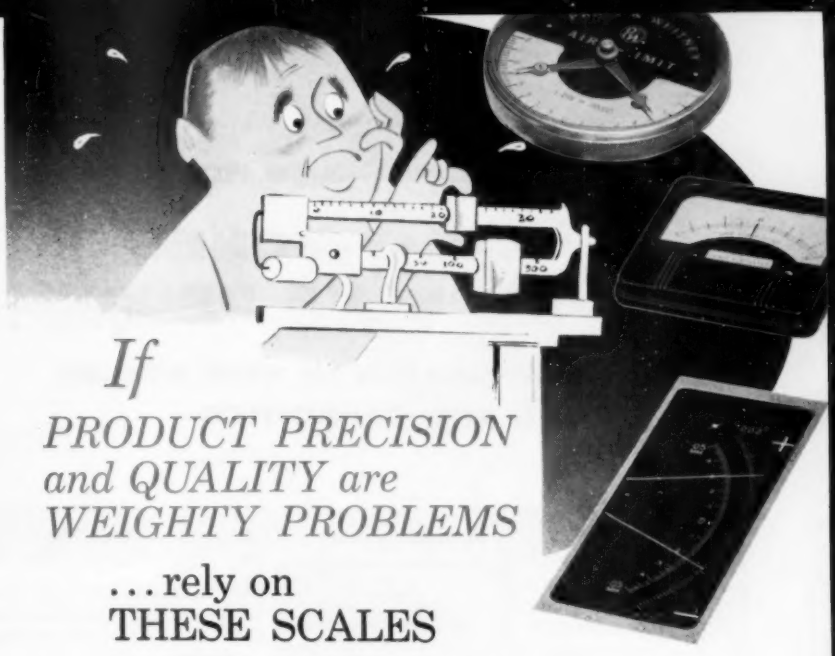
In addition, the book outlines an important application of the strain gage—its use as a transducer element for instrumenting and controlling mechanical variables, such as force, load, torque, speed and pressure.

An instrumentation chart to aid in selecting the proper system is included.

AN ENCYCLOPEDIA OF THE CHEMICAL PROCESS INDUSTRIES—*by Jeffrey R. Stewart. Published by the Chemical Publishing Co., Inc., 212 5th Ave., New York 10, N. Y. Price $12. 820 pages.*

The purpose of this book is to provide authentic and practical information of interest to manufacturers, educational institutions, industrial consumers and all those actively engaged in the chemical process industries.

It treats the practical aspects: raw materials, processes equipment and finished products of the industries in an encyclopedic form. It also lists definitions of technical and scientific terms which are frequently encountered.



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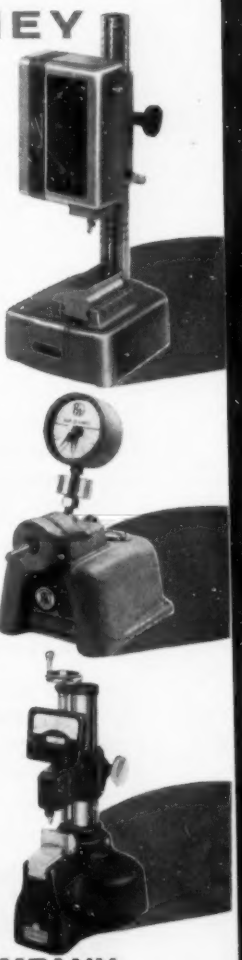

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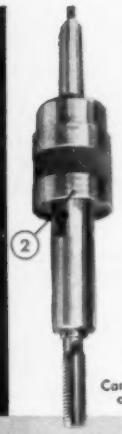

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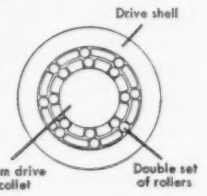
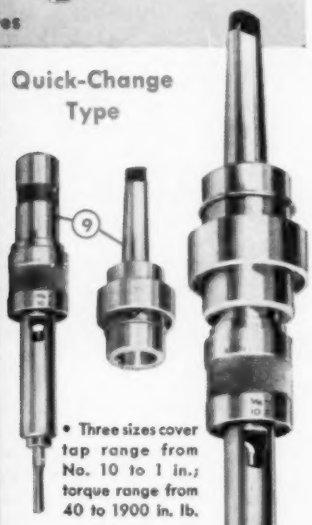
- Two sizes cover tap range from ½ to 1½ in.; torque range from 500 to 2400 in. lb.



These benefits . . .	for these reasons . . .	result from these PREMIUM features
PREMIUM TOOL LIFE	Reduce tap breakage. Control adverse tapping conditions, such as dull, soft, improperly sharpened taps, faulty holes, or changes in material.	1. One-shot clutch and cam-drive collet completely disengage tap from driver when pre-set torque is reached.
		2. Pre-set torque remains constant. Wide range of torque settings to suit tap and material.
PREMIUM QUALITY TAPPED HOLES	Produce uniform, accurate threads.	3. Freewheeling action when driver releases eliminates impact and objectionable vibration in threads.
	Help prevent use of dull or improperly sharpened tap, or wrong tap for the job.	4. Releases instantly at proper setting, which remains constant.
		5. Tension and compression type compensates for feed variation between spindle and tap.
PREMIUM PRODUCTION EFFICIENCY	Operator gains confidence, more free time for other work.	6. No noise or impact on release. Tension and compression type spring loaded for cushioned stop.
	Use higher speeds on all tapping jobs.	7. Driver can operate at any speed taps can take, no slow down for blind holes.
	Reduce downtime.	8. Constant torque gives you dependable control over adverse machining conditions.
		9. Quick-change type permits tool changing without stopping machine.
PREMIUM PROFIT OPPORTUNITY	Driver has wide application.	10. Variety of drivers available to help solve almost any tap breakage problem.
		11. Torque easily adjusted for variety of materials and tap sizes.
	Driver has long service life.	12. Freewheeling action minimizes wear.

Quick-Change Type



- Three sizes cover tap range from No. 10 to 1 in.; torque range from 40 to 1900 in. lb.

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Manufacturing Costs

How They Are Influenced by Product Design

Tech Digests

By Lad J. Bayer
Chief Industrial Engineer
The Warner & Swasey Co.
Cleveland, Ohio

PRODUCT DESIGN characteristics determine manufacturing costs. The common objective of both product design engineers and engineers who plan the manufacture of a product is to obtain optimum quality at lowest cost. Unfortunately, design engineers have little more than personal experience or common sense to guide them toward this goal during the formative stages of design or even during the preparation of detailed drawings.

Function, durability and appearance are the three criteria of over-all quality. Cost and quality cannot be separated; they have a natural tendency to behave as directly proportional variables. Improvements in quality often result in increased cost and, conversely, lower costs often result in lower quality. Product design engineers, however, are continually challenged to force cost and quality apart. They must endeavor either to maintain quality at lower cost or to improve quality at a fixed cost. In attempting to carry out such assignments, design engineers consistently are handicapped by lack of cost information that will aid in the selection of quality levels which are within acceptable margins and within reasonable cost boundaries.

Developing Cost Patterns

As a result, product designers are faced with two alternatives: to engage in time-consuming research or to gamble on assumed conditions. In many instances it is necessary for designers to postpone consideration of costs into the future, when cost information will become available through actual production experience. At that time, positive and corrective action will be possible.

Some areas of quality can be resolved into definable increments which lend themselves to measurement. Standards of dimensional tolerance and surface roughness are not new to industry. It should therefore be feasible to track down cost patterns in relation to these standardized quality increments.

At Warner & Swasey, these cost behavior patterns were hidden in the industrial engineering data designed for use in plant operational control. They were not readily apparent because the data were in a language specifically suited to that use. If a way could be found to extract, translate and condense the information into a form meaningful at the drawing board, it would provide design engineers with some of the information necessary to evaluate the effect of quality on manufacturing cost, and result in reduced engineering time and development expense as well.

Cost Comparison Charts

Using available data, analyses were made to test the practicability of the idea and to verify that quality specifications and industrial engineering data

Fig. 1. Relationship between cutting costs and surface finish in turning operations.

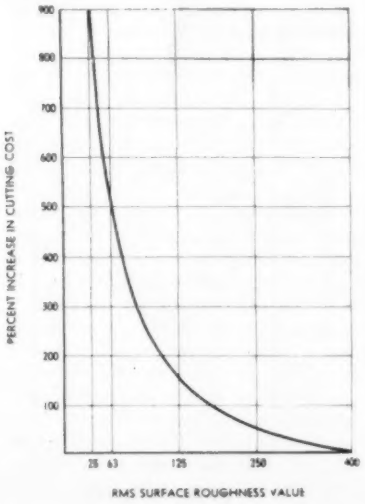


Fig. 2. Drilling costs increase with hole depth. Dotted line emphasizes accelerated costs when depth is more than three times the diameter.

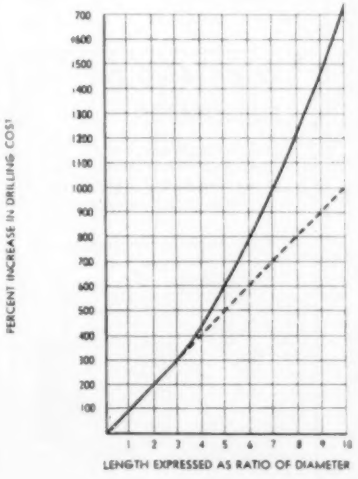
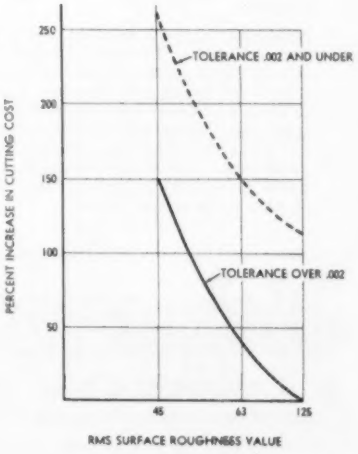


Fig. 3. Effect of varying tolerances and surface finish on face milling costs. Rise in costs with increase in piece-part quality is graphically evidenced by curves.



could be compounded into simplified form. The findings demonstrated that it was possible to plot variables of quality against variables of cost, obtaining charts that are easily understood and quickly read.

The accompanying charts are examples of the results obtained. At present they are limited in scope but it is hoped that future developments will expand the idea into broader areas of design features. *Fig.* 1 illustrates a representative cost comparison chart in which cost is plotted with respect to surface quality standards. It is limited to turning done on turret lathes. The choice of functional surface quality for any such application can be made easily, with full knowledge of comparative cost, by referring to the chart.

The chart in *Fig.* 2 was prepared to illustrate the cost behavior of holes drilled on standard machines. It is apparent that deep holes are expensive. When hole depths exceed three times the diameter, the cost rises rapidly.

In *Fig.* 3, the effect of two design variables, surface quality and dimensional tolerance, can be perceived. The chart is for a face milling operation. It is interesting to note the wide cost differentials throughout the range of defined quality.

The chart covering cylindrical grinding costs, *Fig.* 4, is unique in that it exposes a nonuniform cost behavior

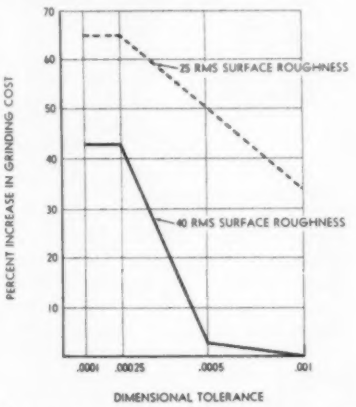
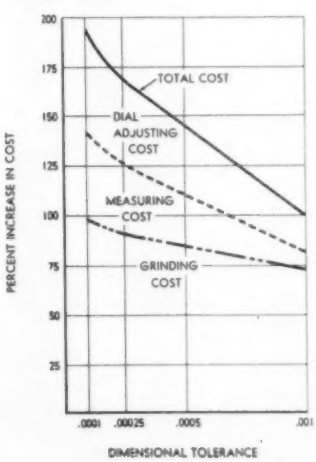


Fig. 4. Surface finish and dimensional tolerance requirements both affect cylindrical grinding costs.

pattern. As can be seen, the 40 rms surface quality line shows a minor cost rise between the 0.001 and 0.0005 tolerances. The 25 rms surface quality line, on the other hand, reflects a more normal and usual cost behavior.

In preparing the chart on internal grinding, *Fig.* 5, the intent was to expose some of the hidden elements that compound into the resultant cost behavior. From the chart it is apparent that as tolerances become smaller, substantial cost increases occur, brought about by the necessity of increased

Fig. 5. As tolerances decrease, added dial adjustment and measuring by the machine operator increase internal grinding costs.



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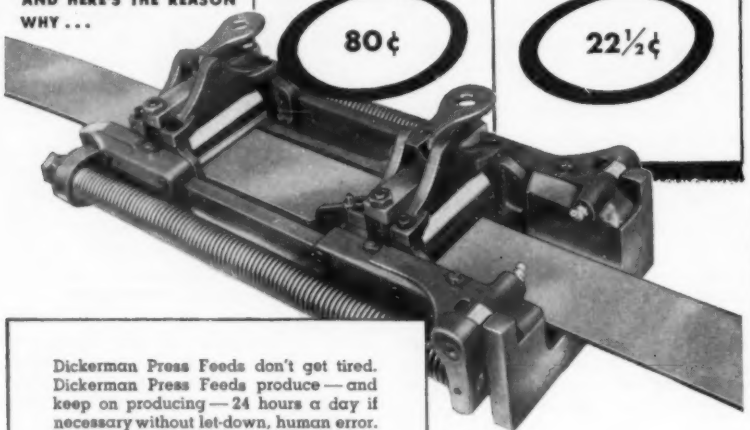

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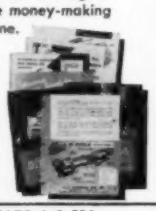

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gaging and machine adjustment.

Since the charts illustrated were tailored to suit the conditions of the plant under study and are based on data confined to that plant, the cost behavior patterns observed may not wholly agree with the experiences of other plants. Recognition must be given to the fact that differences in facilities, processing methods and quality range will affect the character of the cost behavior pattern. Nevertheless, the idea or principle is applicable to any manufacturing organization. The ease with which cost behavior data can be prepared will be determined by the degree of quality standardization and availability of corresponding industrial engineering data.

From paper 56-SA-9 given at the ASME Semi-Annual Meeting, June, 1956. The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

How to Program Tape-Controlled Machines

By L. W. Herchenroeder
Industry Engineering
Westinghouse Electric Corp.
East Pittsburgh, Pa.

Numerical control of machine tools has excited the interest of machine tool builders, users and electrical manufacturers. The benefits to be obtained by external programming of the operations of an automatic machine on cards or tape are attractive and a number of machines have been and are being built to obtain these benefits.

Functions

The various functions involved in the numerical control of a hypothetical machine tool are shown in the accompanying sketch (next page). Some systems have fewer functions than listed and they may not be in the same relative locations. This will affect the apparatus physically but is not important for the consideration of the basic aspects of numerical control. Usually, though not necessarily, a drawing of the part to be produced will represent the starting point for development of the program. From this drawing, the next step is to prepare a manuscript containing a detailed description of all machine operations necessary to make the part. This description will include such items as the tooling to be used, distances to be moved, feeds, speeds, and auxiliary operations. Information on the manuscript is then transferred to the program stor-

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age medium in the form of cards or tape which for relatively simple systems may serve as the input to the machine controls.

More complicated systems, such as those for contouring, usually require that the cards or tape be fed into a computer where the tool path, including cutter offset, is calculated and recorded in the primary storage medium. Interpolation is performed in the director which generates the secondary storage medium as the input to the actual machine control shown in dotted lines in the sketch. As part of the machine control a reader is required to extract the information from the secondary storage medium. The data must be stored while being used by the control system; this storage may be accomplished by the reader itself or by internal storage in the machine control, according to the particular system.

At this point, position data are fed to the closed loop systems controlling the machine motions. Since the actual machine motions are analog in nature while the data taken from the drawing are digital, a digital-to-analog conversion must, therefore, the place at some point in the programming or in the control system. The exact point at which this conversion takes place will depend on the individual system. It may occur at the last possible point, at the machine motion itself, but in some systems conversion is performed in the computer so that the data in the secondary storage are analog.

Applications

From the standpoint of application, numerical controls for machine tools can be divided into three groups, according to function of the machine; these are controls for positioning, straight cutting, and for contouring.

Positioning control, most simple of the three types, may be used for drilling and punching operations. In this type only the end points of travel are of interest and overshoot may be tolerated. In general, it does not matter what path is taken between two holes except that the path chosen may, of course, affect the time required for travel. Too, a choice of path may be restricted by the necessity of avoiding obstructions.

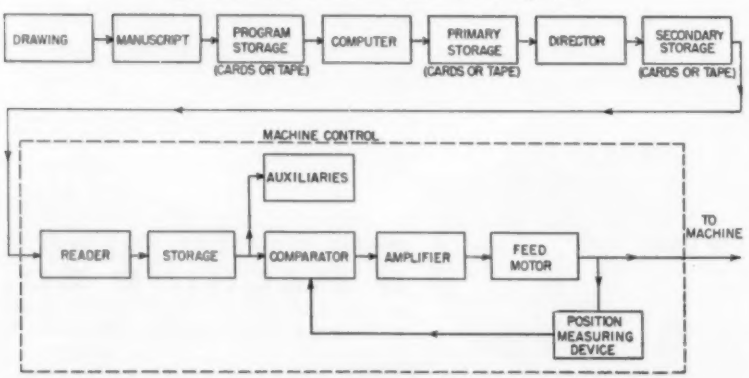
The next order of complexity is represented by straight-cut control such as would be used for the turning of a stepped shaft in a lathe. In this type, position of the tool must be controlled, not only at the end points, but at all points along the path of the cut. The feed rate must also be controlled and overshoot is not acceptable. More than one machine motion is usually required; however, when two or more motions are used at the same time, coordination between the position controls is not required.

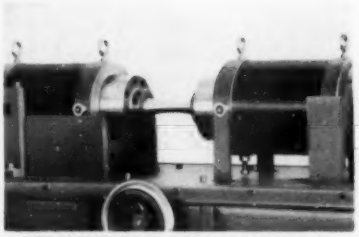
Contouring control, the third group, requires the programming of any tool path that can be generated by the machine motions. Usually simultaneous position control of two axes is present including control of the feed rate. The necessity for programming the feed motions in small steps in order to follow arbitrary curves, and the necessity to make correction for cutter offset make contouring control much more complex than positioning or straight-cut control.

Systems

From still another standpoint, numerical control systems may be classified as incremental or absolute systems, depending on how the position data are handled. Incremental systems specify a new position in terms of the distance and direction from the last position. Absolute systems specify each position in terms of the distance from some arbitrary base. In an incremental system, an error in programming a given position will affect all succeeding positions.

Typical functions of numerical control system.





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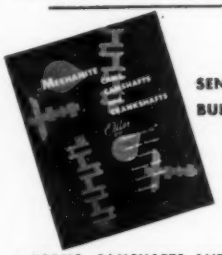

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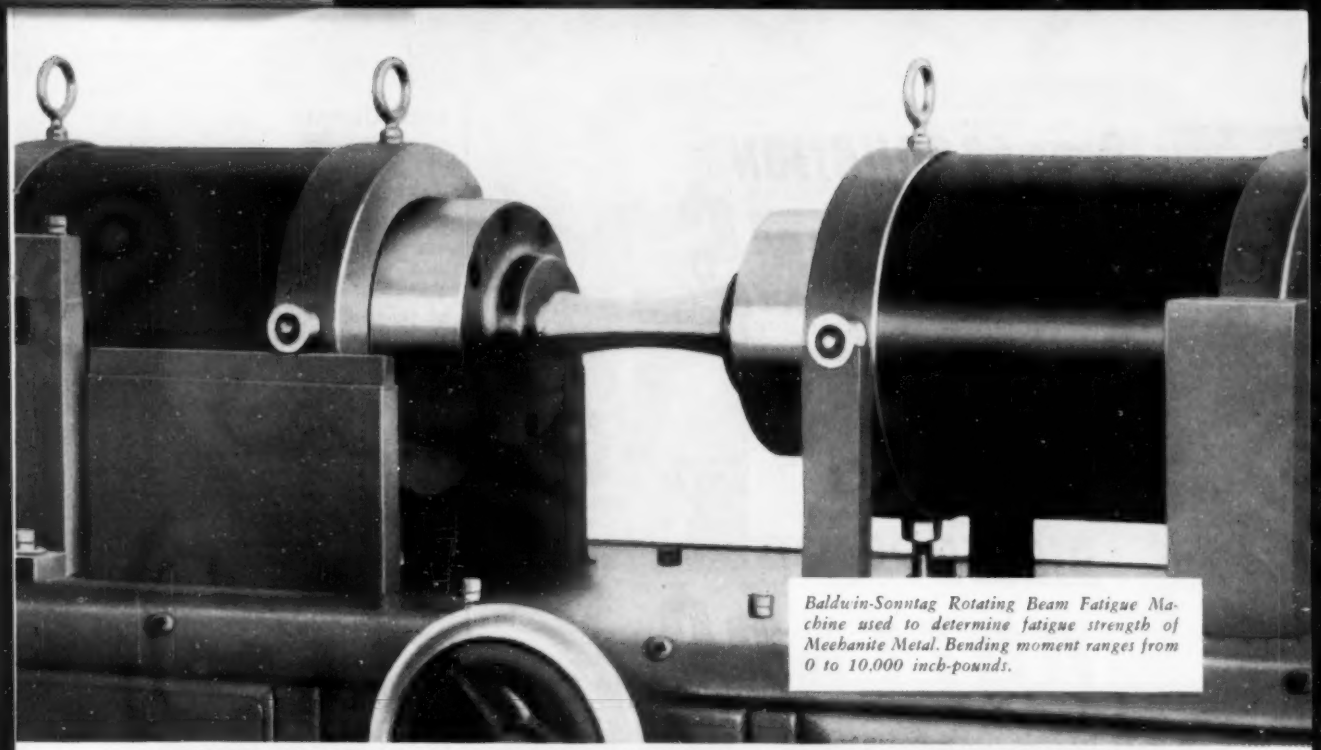
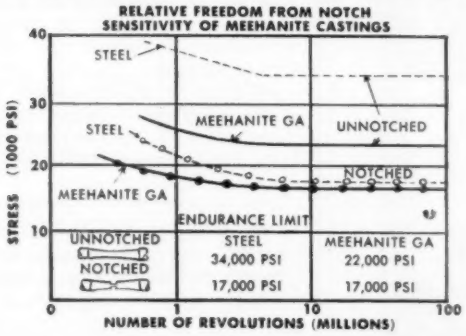


Baldwin-Sonntag Rotating Beam Fatigue Machine used to determine fatigue strength of Meehanite Metal. Bending moment ranges from 0 to 10,000 inch-pounds.

MEEHANITE CASTINGS SHOW HIGH RESISTANCE TO FATIGUE UNDER ROTARY BENDING STRESSES



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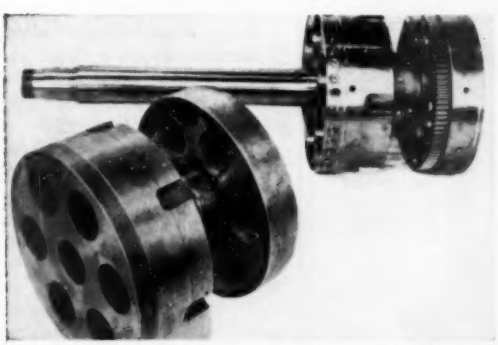
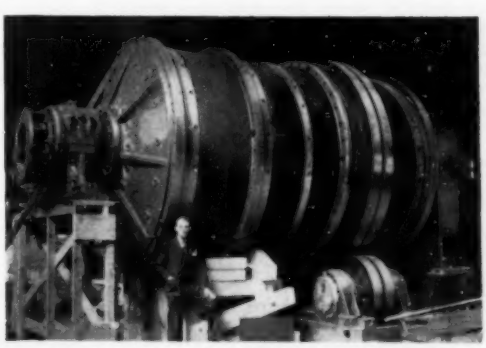


Meehanite spindles for automatic bar and chucking machines withstand rapid and heavy torque shocks and maintain accuracy of tool alignment during service.



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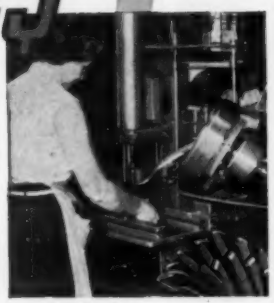

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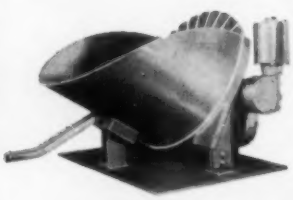

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tech digests

With the absolute system an error in programming is not passed on to succeeding positions. For incremental systems, power failure presents a problem in that the system may lose its memory of position, thus making it necessary to go back to some base point to pick up the program. However, the apparatus required for an incremental system is more simple and, therefore, has greater inherent economy and reliability than an absolute system.

From a paper presented at the 20th Annual Machine Tool Electrification Forum, sponsored by the Westinghouse Electric Corp., Buffalo, N. Y.

▼ ▼ ▼

Predicting Success in Industry

By Winston E. Koek
Director, Audio and Video Research
Bell Telephone Laboratories
Murray Hill, N. J.

Facing a serious shortage of college graduates in science and engineering, American industry is embarking upon a program of college recruiting far exceeding in magnitude any such efforts in the past.

No longer is a man selected by industry solely on the basis of his scholastic record. As industry, and particularly research, become more and more a cooperative endeavor, mental ability is not an adequate criteria. Personality and ability to work with others must also be considered.

FOR AVAILABILITY OF COMPLETE PAPERS WRITE THE HEADQUARTERS OFFICE OF THE SOCIETY NOTED AT THE END OF EACH ABSTRACT.

In addition to a man's scholastic record, an appraisal by his professors is useful in predicting his future capabilities. The professor grades according to a student's scholastic abilities, but he has ample opportunity to appraise him in other ways which do not enter into the grade sheet.

A third and highly important guidepost is found in reviewing honors and awards which undergraduates receive. Scholastic ability also enters into this, but additional qualities of leadership, professional interests, activities and personal integrity are major considerations.

The industrial interviewer has only

the short time of the interview in which to appraise the man's personality and reliability. In the selection by an honor society, the man is judged by fellow students and professors, and they have had long experience in knowing the individual and his particular traits and characteristics.

These broader aspects of a student's character such as personality and breadth of interest, achieve the greatest importance after graduation. Students of today will be industrial leaders of the future, and the problem of management is one of improving human relations and morale in industrial organizations. Increases in effective management may yield gains in industry comparable to the possible technical gains. This suggests that the manager of the future will come from those graduates of today who have varied interests, both professionals and non-professionals, good personalities so as to be able to deal with people and talk with them and qualities of leadership to gain respect of others.

From a speech, "Undergraduate Honors," given at the University of Cincinnati, 50th Anniversary Observance, April, 1956.

▼ ▼ ▼

Developing Special Automatic Equipment

By Herman Melzer

Division Manager
Equipment Development Plant
Sylvania Electric Products, Inc.
Emporium, Pa.

Before talking about mechanization and automation, it is well to define the terms. At the Radio Tube Division of Sylvania Electric Products, mechanization is defined as the process of introducing mechanized manufacturing equipment to replace manual operations or to replace machines using operators. Automation is defined as the result of linking already highly mechanized individual machines together. A further concept of automation is continuous-flow production, as opposed to processing intermittent batches of work. The primary reason for using special mechanized or automated machines is, of course, to reduce manufacturing costs. Other factors, such as improved quality, reduced operator fatigue and elimination of safety hazards, are also important.

Before the decision to design, build and develop mechanized or automated equipment is made, several important factors must be considered. The first of these factors involves management. Only under patient and progressive management is it possible to acquire and use this type of equipment. A progressive management will realize that any special machine will have more faults than a standard machine by virtue of being the first of its kind. If management has confidence in its development organization, it will know that these faults will be corrected as they arise.

A second factor is the availability of skilled toolmakers, machinists and expert maintenance mechanics. With complicated high-precision manufacturing machinery these skills are a "must."

The third factor is the attitude of production personnel. The success or failure of special equipment is dependent, to a large degree, upon the cooperation between production, maintenance and development people. Production personnel must be convinced from the start that their interests are being considered and that they are part of the team. At Sylvania they are brought into design meetings and their suggestions and opinions are given careful consideration.

Evaluating Ideas for Equipment

Ideas for mechanized equipment come from many sources at Sylvania. The job of screening out those which are not practical from an economic standpoint is of utmost importance and requires an extremely accurate analysis of the many factors involved. Labor savings can be roughly estimated at the time of screening by assuming a production figure for the proposed method. In most cases, the cost of the equipment can be roughly

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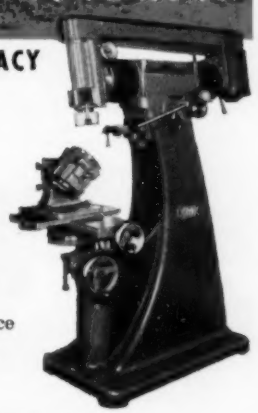
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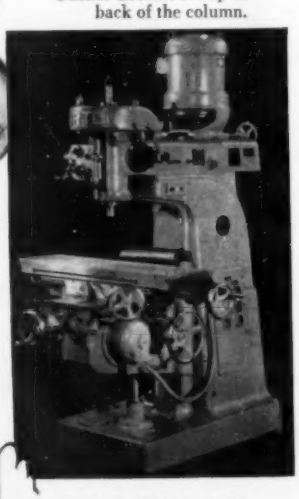

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estimated. If these figures are favorable the division industrial engineering department is asked to make a detailed analysis. When the job is sizeable, a meeting of production supervisors, product design engineers, quality engineers, industrial engineers, equipment and development plant engineers, and accounting personnel is held for the purpose of discussing the proposed equipment.

Estimating Costs

In estimating the cost of a proposed machine, the cost of designing, building and deveolpment is included. The most difficult part of the estimate is determining how much development will cost. At Sylvania, development costs have run as low as 10 percent and as high as 100 percent above the cost of building the machine originally. A fair average figure to use is about 20 percent in most instances. The cost of a new machine should be paid off in two years.

In order to determine if a new machine is a good investment, a number of factors should be investigated:

1. Is factual information on present production available?
2. Has consideration been given to making changes on present equipment?
3. Will the new piece of equipment unbalance other equipment now in use?
4. Will the cost of the new machine be amortized before it is obsoleted?
5. Should the product designer consider any product changes in order to simplify the new machine?
6. Should the machine be made universal so that it can handle various sizes of related products?
7. Have the initial, replacement and maintenance costs of tools required on the new machine been considered?

These factors, properly evaluated, will show whether the proposed equipment is a worth-while investment. If so, actual design layouts can be started.

Equipment Design

Over the years, Sylvania has built up a number of equipment development plants where special machines are designed and built. These plants are staffed by specialists in carbides, alloy steels, hydraulics, electronics and related fields, who can be called on to assist in designing special machines.

The first step in design is to make rough layouts and models. A design conference is conducted after these are made for the purpose of trying to over-

come flaws in the design. This is the most economical time to correct mistakes in special machine building. The initial design conference includes only people in the equipment and development plant. If the rough layouts are approved, a second conference, which includes production supervision, industrial engineers and product engineers, is held to acquaint these persons with the design.

During the design stages, cost estimates are kept up to date. When the estimates are as complete and accurate as possible, a final cost savings analysis is submitted and requests are made for appropriation approval to start detail drawings, assemblies and machine construction.

Machine Construction

During the building of the machine, designers work closely with shop personnel on machining and assembly problems. Drawings are revised as needed and suggested changes by shop personnel are given consideration.

Making the machine work requires a high degree of ingenuity and patience. Special machines are not built by pessimists and they seldom justify the optimism of their builders when first tried out. When the machine begins to perform with reasonable success in the development plant, it is time to attempt production. At this point, the machine is moved into the production plant. Operators and maintenance employees are carefully trained and machine troubles are ironed out.

Within a reasonable time after the machine is in production, rates, efficiency and related factors are studied by an industrial engineer to determine if cost savings data are up to date and correct. In actual practice, many special machines run faster in production than indicated in the original estimate.

From a talk given at the Pennsylvania State University Automation Seminar, June, 1956.

▼ ▼ ▼

Operations Research in Education

By Frederick L. Hovde
President, Purdue University
Lafayette, Indiana

The goose that lays the golden eggs of technology is the system of higher scientific and engineering education—producing trained and creative minds to man laboratories and industrial plants in the nation. People come first in all considerations. Nothing can be done without them. The better they are, the better the operations.

As a nation, this country has great natural resources, a diminishing asset, however. The nation is small in terms of man power compared with the Russians, Chinese, and Indians. The superior asset at present, is the amount of the thing called "know-how," knowledge in its broadest sense.

This too is a diminishing asset. Scientific supremacy cannot long be maintained unless this nation gives vigorous, clear thinking, support, money and priority to selection and training of the available supply of talented young people.

It cannot be done if the future welfare of the educational system is left to someone else to worry about. There are far too few dedicated people willing to teach and do basic research in universities on salaries that are less in purchasing power than in pre-war days.

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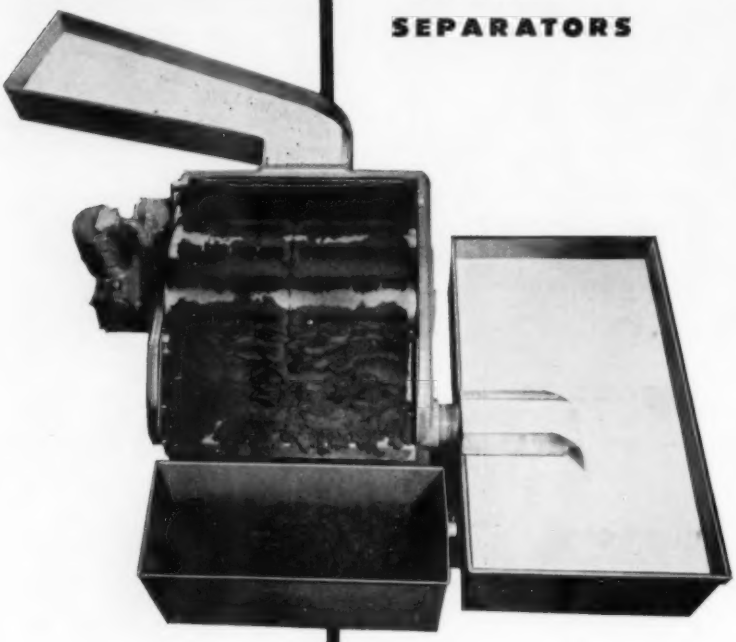

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value in many phases of industry and government. There is good reason to suppose that these analytical methods can contribute significantly to the management of large educational enterprise. The problem boils down to maximizing the effectiveness of teachers, use of facilities and placing primary responsibility for learning on the students.

Some studies, using techniques and methods of operation research are already underway in various institutions. These have been stimulated by the pressure of increasing costs and growing number of students.

Problems are many and those in higher education are deeply gratified with the growing recognition and assumption of responsibility for help to higher education from industrial leadership throughout the country.

From a talk given before the Technical Societies Council of the Niagara Frontier, Feb., 1956.

▼ ▼ ▼

Learning to Use Automatic Computers

By Thomas J. Walsh
Case Institute of Technology
Cleveland, Ohio

Several types of training are available for the new electronic computers. There are special courses given both by universities and manufacturers, seminars and within-the-plant training.

Less formal training is possible when a group operating a computer has time and technical training to set up and solve problems proposed by other groups of personnel. Private study is also possible. Many articles are available describing the solution of particular problems. Along with this, a computer, any computer, should be located and permission obtained to use it. Mastery of this computer will evolve from setting up and solving arbitrary problems on it.

Without a computer, little progress can be made. But small limited-use computers are inexpensive. For instance, a graduate student built a computer to solve solvent extraction problems at a cost of $135 for parts.

Cross fertilization of ideas developed by mixing a group of various engineers and scientists is good. Curricula at this school is still experimental. The first formal course was a study of the electronic analog computer. Topics covered included use of electronic amplifier circuits for addition, multiplication by a constant, and integration.

From here, use of circuits for squaring and problems of multiplying variables or differentiating were reviewed together with techniques for circumventing these problems. Following this, solution of equations using multiple and interconnecting circuits was developed.

Problems from many areas of engineering were then set up on the analog computer. This unit has a board on which a problem may be wired and preserved. Different boards may be inserted into the panel for different problems. Results may be read out on an oscilloscope or a Brush recorder. Input variables may be fed in varying as sine wave, step functions, triangles.

Computer Training Aids

The simplest digital computer is the abacus. Students have made these from wire coat hangers. Another simple device is the pocket adding machine. An understanding of these machines, particularly how to multiply by adding and divide by subtracting leads to a basic understanding of the digital computers. Most digital computers can add or subtract two numbers. For convenience, one of the numbers may be stored in the computer. For speed, the numbers usually are set up in the binary system. This speed is within the machine rather than in seting up the problem. Background in this phase of arithmetic is a help but not a necessity, if it is understood that the digital computer is a device that has a memory and can add or subtract rapidly. It must be given instructions carefully to know what to add to what. This is called "programming."

When an engineer knows how a computer works, he can determine what changes are necessary to solve a new problem. He can determine ways to improve accuracy or can save time in a computational setup. Sometimes a new gadget must be designed to make the computer solve the problem economically. Routine solving of a problem, using someone else's program of procedure is not engineering. The creative engineer will want to solve his own problems. To do this, he should understand why the computer works, as well as how.

From a paper given at the National Meeting, Feb. 1956, of the American Institute of Chemical Engineers, 25 W. 45th St., New York 36.

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What to Expect of an Engineer

By Erwin K. Taylor
President
Personnel Research and Development Corp.
Cleveland, Ohio

Engineers are human beings. As such, they have the same wants, needs, urges, ambitions and personality characteristics as their fellow men. As a group they are higher on some of these attributes than the average of the human race. The differences among them are much more noticeable than are their similarities.

The explosive expansion of engineering has led to as much specialization as frequently is attributed to the medical profession. Today there are literally dozens of specializations in the engineering curricula. In a single firm, more than fifty distinctly different engineering jobs were reported recently. These call for different skills, different abilities, and different personality characteristics.

Many companies now employ engineers in almost every imaginable field, whose sole function it is to meet with client companies in order to help them find ways and means of solving problems. These men derive pleasure from the feeling of helpfulness and by earning the gratitude of those they assist.

There are engineers who are talkative, competitive, even argumentative. They may not fit the antiquated stereotype but they do hold engineering degrees. For them there are hundreds of high-paying sales positions where they can put their technical training to excellent use and at the same time indulge their needs for social interaction, aggressiveness and dominance.

There are, of course, lovers of detail—those who are more interested in things than in people. There are still plenty of jobs in engineering for them.

For the curious and adventuresome, there are new areas to be explored in electronics, nucleonics, in communications, in weapons and weapon systems, in supersonics and other fields of research and exploration.

What's Wrong with the Engineering Profession?

But what of the ambitious engineer, the one who wants the status symbols and dollars that go with an executive job. For him, too, if he has the basic ability, there is room for rapid growth, satisfaction and expansion. American industry as never before is searching for executive talent and finding a considerable proportion among engineers.

Many employers of engineers, seeing only the stereotype, seem to believe that engineers are unfeeling automatons. Morale-building attributes of the work situation are denied them. They frequently are not invited to participate in formative stages of the work in which they engage. They are too frequently housed in what constitutes a cerebral sweat shop, overcrowded, noisy and public. While competition has made the entry salary fairly attractive, promotion is frequently extremely slow. Too often work is confined to narrow bounds and suggestions and signs of originality are ill-received.

A survey of an eastern development firm recently found a majority of engineers felt they had no part in management planning, and were inadequately informed on management aims and long-range plans. Nine-tenths said they would like to participate more in these activities and many felt their authority was not commensurate with responsibility.

The engineer should be considered as a human being and placed in an appropriate field of endeavor. He should be assigned an environment that supplies him with the ego satisfactions and statute symbols everyone needs. Then he can be expected to be a diligent, productive person.

From a paper presented at the 13th Annual Machine Design Conference, Cleveland Engineering Society, 2136 E. 19th St., Cleveland, Ohio, Feb., 1956.

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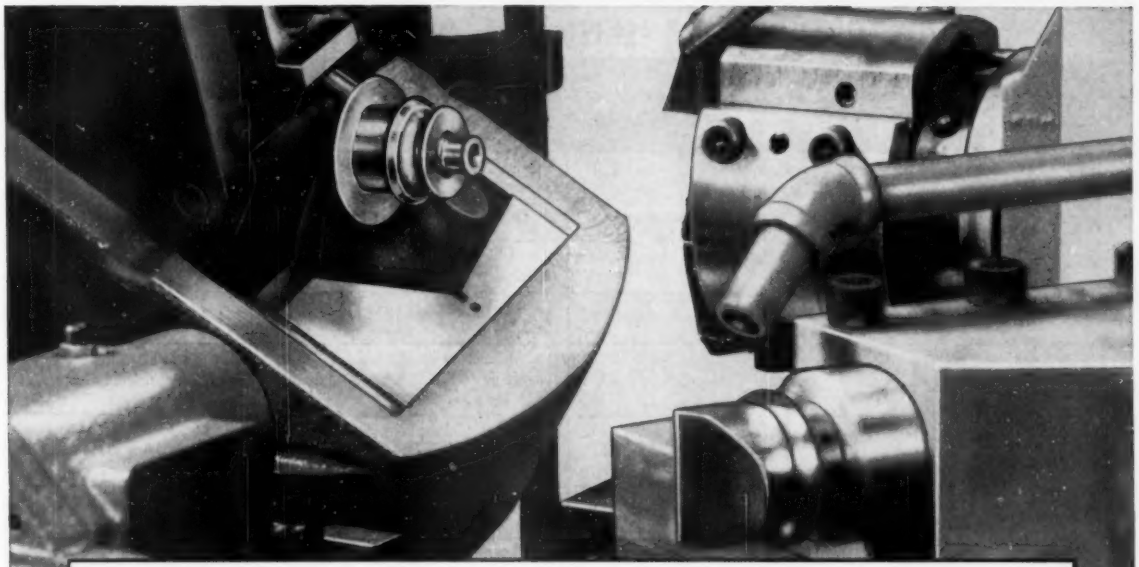

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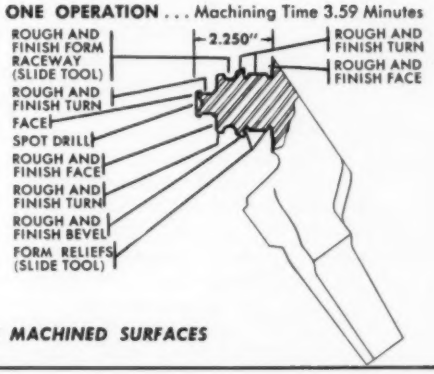

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K90	85.0	360,000	61,600,000	518,000	Heavy blanking dies up to 3/16" steel. Dies for: cold-heading, nail gripping, nibbling, swaging steel rods, heavy curling, coining.
K91	86.5	380,000	64,400,000	540,000	Light-heavy blanking up to 1/16" steel; rivet sets, crushing hammers, washers, dies.
K92	87.5	385,000	71,900,000	572,000	Lamination dies on .004" to .035" silicon steel; medium blanking dies softer metals up to .040"; heavy forming dies; heavy heading machine hammers; hardware curling dies.
K94	90.0	325,000	77,900,000	600,000	Tube swaging dies; light blanking up to .020" silicon steel; medium blanking, softer metals up to .040"; heavy forging dies; heavy heading machine hammers; curling dies for hardware.
K95	90.5	300,000	82,000,000	644,000	Light blanking up to .015" silicon steel, light heading hammers; wear-resistant parts.
K96	92.0	250,000	94,300,000	800,000	Dies for asphalt floor tile; slate-covered asbestos shingles; abrasive-covered roofing papers; and in the paper industry for slitter knives and plates; blanking and pressing dies; compacting dies for powder metallurgy, wear-resistant parts.

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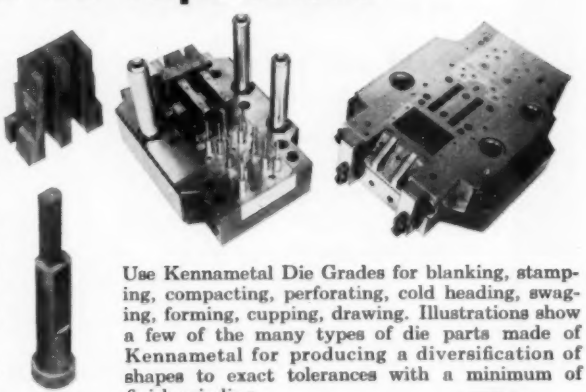

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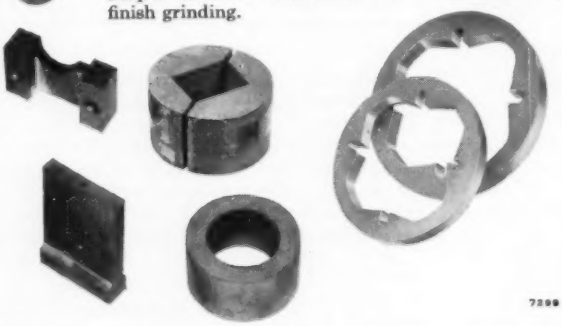

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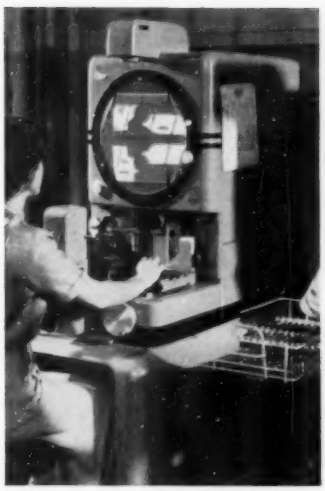
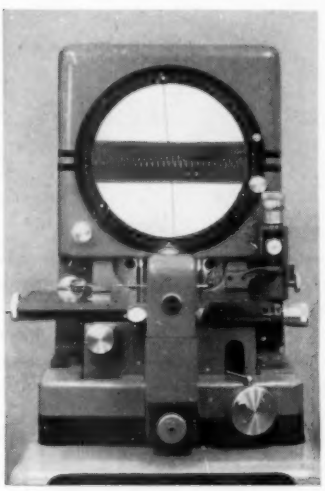
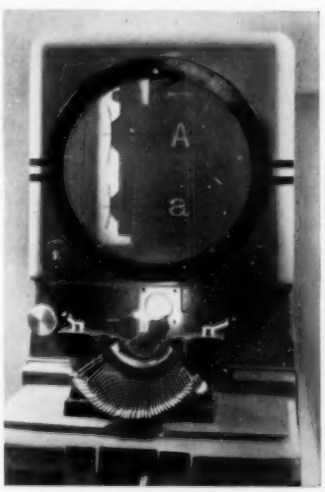


In the toolroom? Look at this. Prior to adopting projection gaging, a Midwestern manufacturing plant required 725 man-hours monthly to inspect flat drills, taps, special cutters, and circular form tools. Use of a Kodak Contour Projector reduced inspection time 84% to 115 man-hours; cost of the projector was returned in direct labor savings within three months. If you have a heavy inspection load in your toolroom, chances are that optical gaging with Kodak Contour Projectors could effect similar savings for you.

In receiving? Here's the experience of a leading maker of aircraft engines. Their gaging procedure on jet engine blades called for inspecting 11 dimensions (including radii and angles) on the dovetail contour, 14 additional dimensions on the blade root. Using two Kodak Contour Projectors, they checked these pieces at a rate of 150 per hour. And operators required little training. What about your receiving inspection department? Couldn't a fast, highly accurate method of inspecting all sorts of parts with multiple dimensions and complex shapes help prevent bottlenecks?



In production? A lot of people don't think of optical gaging in terms of production inspection. A typewriter maker did. To check the alignment of type bars to ±.0002", they placed a Kodak Contour Projector next to the soldering jigs on which bars are mounted on their arms. Catching errors at this point and correcting the jigs reduced alignment time in final assembly 25%. Install Kodak Contour Projectors next to production equipment and you have a fast, continuing check that insures machine settings are correct. That's a good way to keep scrap costs down and quality up.



In final inspection? Ever have a part that was almost impossible to inspect accurately and completely? A leading West Coast electronics manufacturer did. They had to check the precise pitch of a fine wire helix mounted in its glass tube. "Without the Kodak Contour Projector," the company reported, "it would not be practical to make the measurements necessary to get a satisfactory instrument." Many times optical gaging on a Kodak Contour Projector lets you measure small or easily distorted parts with a simplicity and accuracy you can't achieve by other methods.

WHATEVER your inspection or measuring problem, there's a Kodak Contour Projector to do the work, from the bench-type Model 8 to the big Model 30 with its 30-inch screen and large part capacity.

To find out more about how optical gaging can save you time and money, improve accuracy, send for the booklet, "Projection Gaging with Kodak Contour Projectors." Write *Special Products Sales Division.*

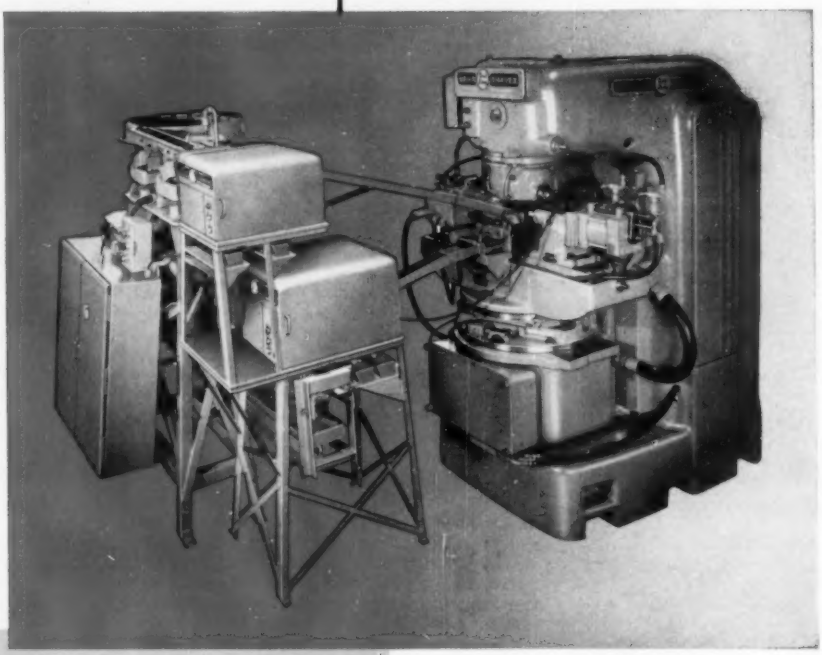
EASTMAN KODAK COMPANY, Rochester 4, N. Y.

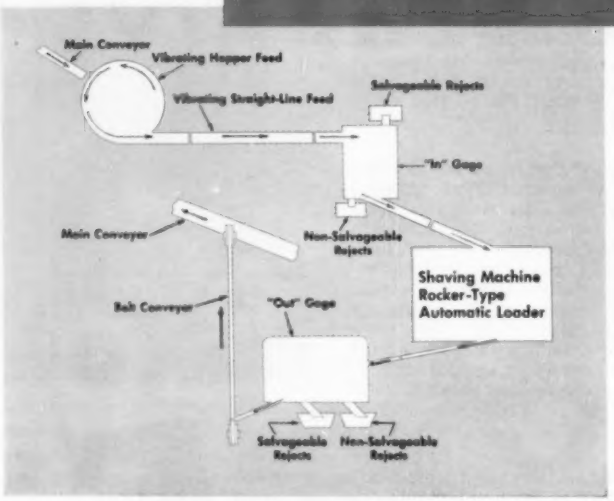
the KODAK CONTOUR PROJECTOR

Kodak
TRADE-MARK

FOR MINIMUM COSTS

SHAVE GEARS AUTOMATICALLY





This is fully automatic Red Ring gear finishing.

Cut gears come in on a conveyor to the storage and feeding mechanism. This may be a vibrating hopper, overhead chute or other device.

These gears are fed into an "In Gage" which screens out undersize and greatly oversize parts, passing only those within tolerance to the Shaving Machine.

After shaving, the gears then go through the "Out Gage" where they are checked for size and helix angle—again screening out the rejects.

Whenever the percentage of rejects goes beyond a selected amount the gage shuts down the shaving machine and indicates by signal lights the nature of the difficulty.

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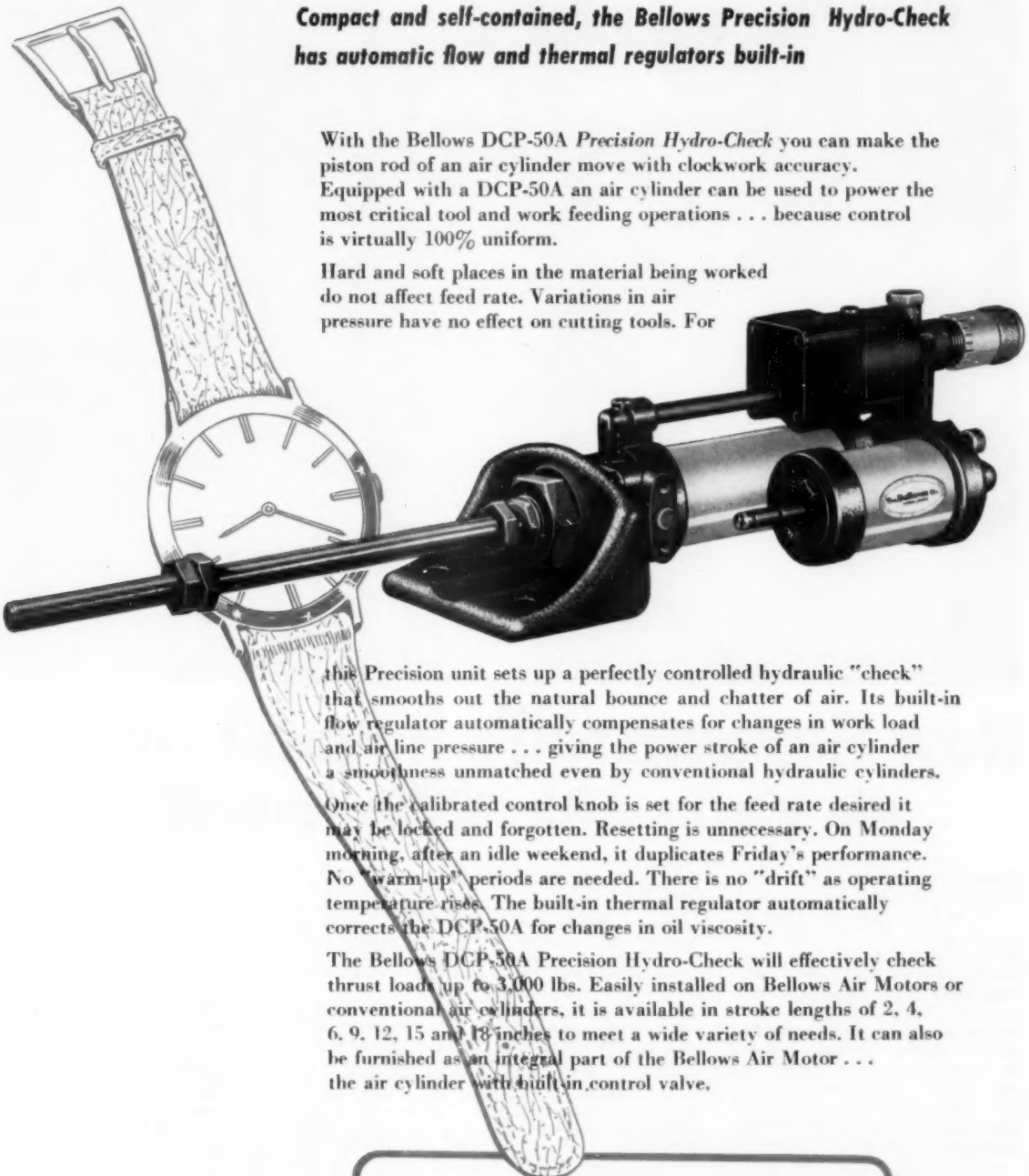
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-218

This hydraulic unit controls air cylinder movement with *21-Jewel Precision*

Compact and self-contained, the Bellows Precision Hydro-Check has automatic flow and thermal regulators built-in



With the Bellows DCP-50A *Precision Hydro-Check* you can make the piston rod of an air cylinder move with clockwork accuracy. Equipped with a DCP-50A an air cylinder can be used to power the most critical tool and work feeding operations . . . because control is virtually 100% uniform.

Hard and soft places in the material being worked do not affect feed rate. Variations in air pressure have no effect on cutting tools. For this Precision unit sets up a perfectly controlled hydraulic "check" that smooths out the natural bounce and chatter of air. Its built-in flow regulator automatically compensates for changes in work load and air line pressure . . . giving the power stroke of an air cylinder a smoothness unmatched even by conventional hydraulic cylinders.

Once the calibrated control knob is set for the feed rate desired it may be locked and forgotten. Resetting is unnecessary. On Monday morning, after an idle weekend, it duplicates Friday's performance. No "warm-up" periods are needed. There is no "drift" as operating temperature rises. The built-in thermal regulator automatically corrects the DCP-50A for changes in oil viscosity.

The Bellows DCP-50A Precision Hydro-Check will effectively check thrust loads up to 3,000 lbs. Easily installed on Bellows Air Motors or conventional air cylinders, it is available in stroke lengths of 2, 4, 6, 9, 12, 15 and 18 inches to meet a wide variety of needs. It can also be furnished as an integral part of the Bellows Air Motor . . . the air cylinder with built-in control valve.

FOR COMPLETE INFORMATION ON BELLOWS HYDRO-CHECKS WRITE DEPT. IE-956

The Bellows Co.
AKRON 9, OHIO

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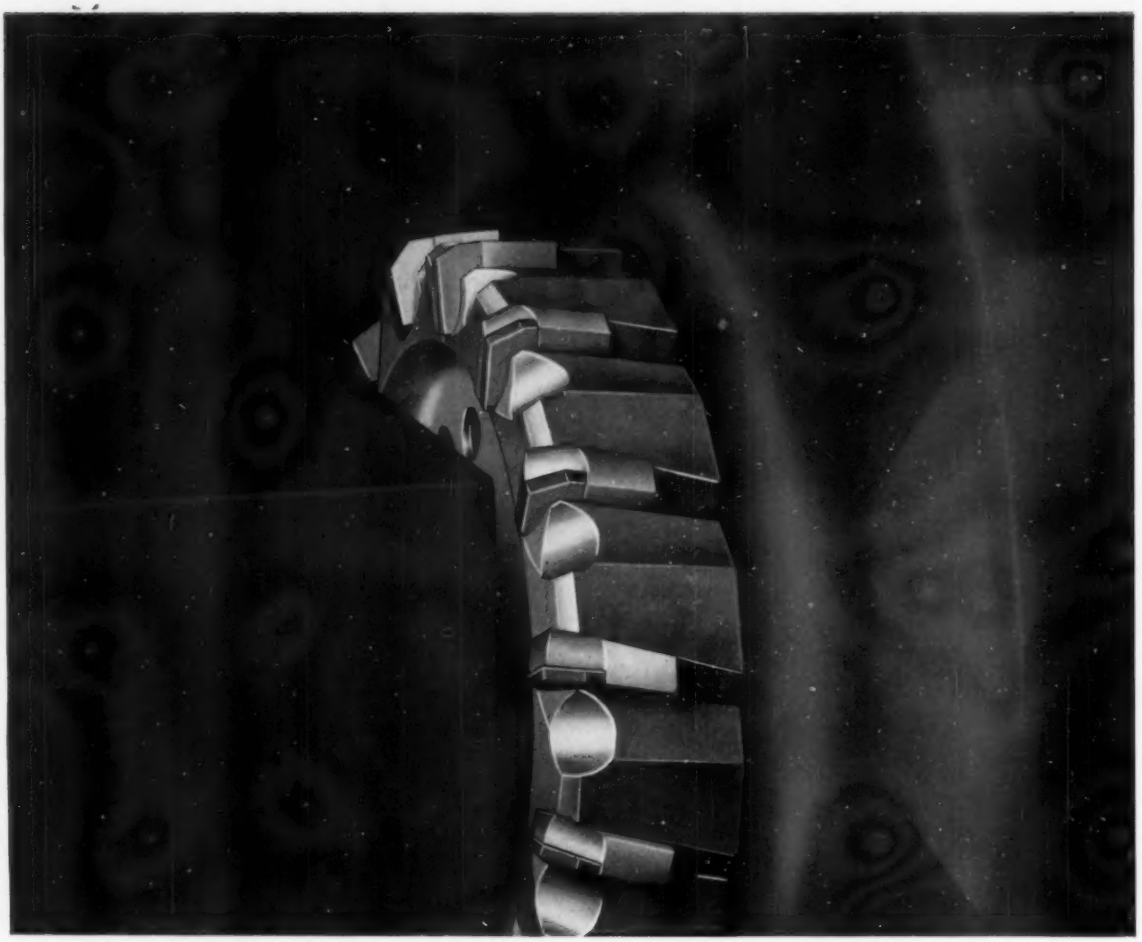

How Heppenstall's hogmill forged die blocks with OK facemills

Close-up made at Heppenstall's Bridgeport shows a 1500 pound, 12 x 20 x 20 inch, Hardtem B forged die block being rough milled with a 14 inch O K 9614XX, extra heavy-duty carbide insert blade facemill, incorporating 10 degree negative axial and radial rake angles. Feed, 150 surface feet per minute. Speed, 8½ inches per minute. Depth of cut, ¼ to 5/16 and often up to ½ inch. Machine, a rebuilt vertical miller with 60 horsepower motor and heavy fly wheel.

IT IS THE SAME STORY EVERYWHERE. Tool engineers prefer O K carbide insert blade cutters for all kinds of tough milling operations . . . facing steel forgings, die blocks, locomotive driving rods, steel castings. There's a reason for this preference. It can be demonstrated by counting the minutes and measuring the metal removed. O K cutters are scientifically designed with various combinations of positive and negative axial and radial rake angles. Scientific designing directs the cutting forces into the body of cutter instead of transversely to the cutting edges. This is necessary because carbides have high compression strength and low transverse rupture strength.

O K cutters are the simplest, the strongest and the toughest ever built. They are heavier, huskier, with more beef in the body. The simple two-piece construction — body and blade — provides more strength and weight to better stand the heavy pull of high powered modern milling machines. Blades are wedge-shaped blocks, the wedge being the strongest mechanical device man has devised. One side of each blade is serrated. Matching serrations are cut into the body. Blades are self-locking, cannot tip or slip. No pins, screws, gibs or locks are needed. To compensate for wear, blades are stepped out one serration and reground. A new set of blades gives you a new cutter. Put your milling problems up to our tool engineers. Write for Catalog 13.

OK

modern milling cutters for modern milling machines

THE OK TOOL COMPANY, INC., Milford, New Hampshire

New

GRAPH-AIR®...

the air-hardening graphitic tool steel for intricate parts that must take abuse!

HERE'S how manufacturers of gages, dies and other steel products requiring stable and machinable and tough steel can find new savings, better performance. The Timken Company announces the latest addition to its line of graphitic tool steels—Graph-Air®. This new tool steel has all the properties of famous Graph-Mo® and it's *air-hardening*. Graph-Air is ideal for such demanding applications as blanking dies and other parts that must stand up to hard abuse. Being an air-hardening steel, there's less distortion in heat treating than with oil-hardening steel—less decarburizing than with other air-hardening steels. And Graph-Air is easier to control in heat treating because it air-hardens at lower temperatures than ordinary air-hardening steels.

Graph-Air not only eliminates the need for oil quenching facilities, and other relatively costly heat-treating processes—it air-hardens at temperatures of 1450°F to 1525°F. This is 200° to 300° lower than most other air-hardening tool steels. Like famous Graph-Mo, Graph-Air *outwears ordinary tool steels* because of the uniform diamond-hard carbides in its structure.

It *machines 30% faster* because free graphite in its structure acts as a built-in lubricant. Graph-Air has the same high stability as other Timken graphitic tool steels, which are the most stable tool steels made!

A result of the Timken Company's pioneering in fine alloy steels, Graph-Air will be available in both solid and hollow-bar sizes. For details, write: The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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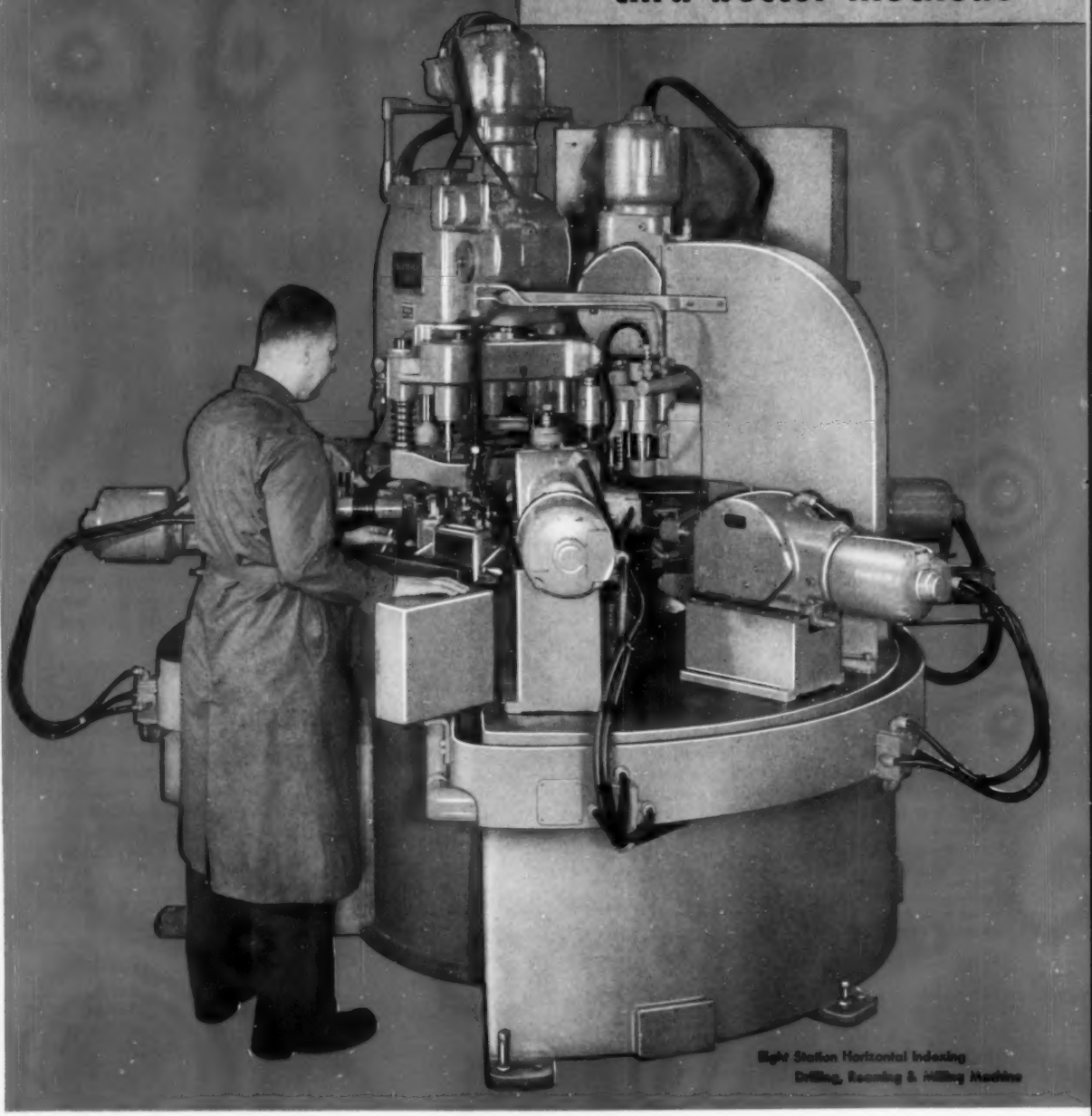

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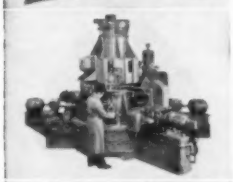
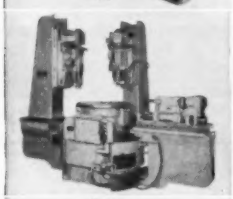
Automatic Production Machines

Double End Trunnion Type Machine



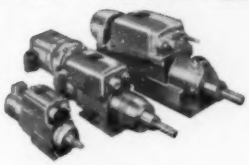
Center Column Indexing Type Machine



Universal Drilling Machine for jet aircraft components

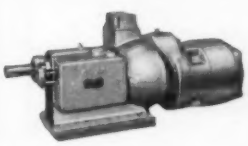
Vertical Single Unit Multiple Spindle Indexing Machine

Standard Machine Components

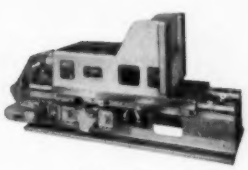


Quill Type Air Hydraulic Drill Units

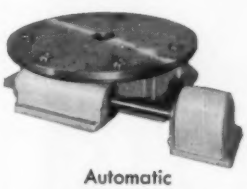
Quill Type Cam Units



Quill Type Lead Screw Tapping Units



Way Type Hydraulic Feed Units



Automatic Index Tables Horizontal and Vertical

Machine Bases

Designing and building automatic production machines like those illustrated are a "Hartford" specialty. Years of experience have proven that dependable high production and economy can best be brought to the user by means of standard machine components.

Now Hartford Special offers these production tested components to users for machines of their own construction.

Consult Hartford engineers for either — completely tooled machines or components.

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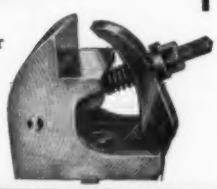

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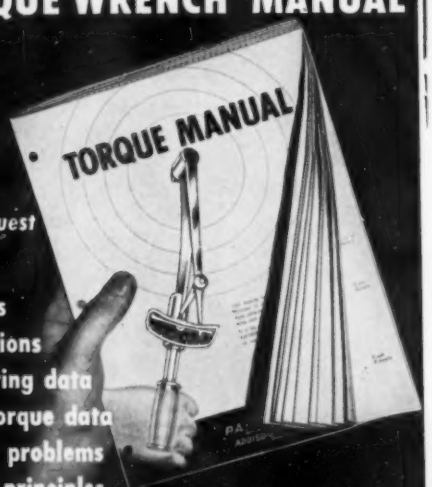
"TORQUE WRENCH" MANUAL



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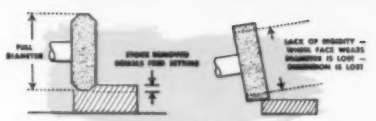
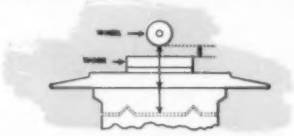
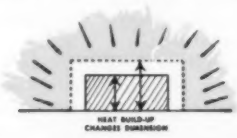
DoALL Takes the Guesswork out of Surface Grinding



The DoALL Maintains Wheel Diameter. The leading edge of the wheel takes the brunt of the cutting. The edge wears but the wheel face and diameter remain intact, assuring accurate stock removal. This is achieved by machine rigidity, smooth table travel and cross feed occurrence before the wheel contacts the workpiece.



The DoALL Maintains Table-to-Wheel Distance Under Load. Absence of spindle and saddle deflection plus a constant thickness oil film on all hand scraped ways assures parallel work travel under the wheel.



The DoALL Minimizes Thermal Expansion. DoALL "Cool-Grinding"* (coolant through the wheel) plus flood cooling controls workpiece temperature, minimizing expansion which produces undersize dimensions when work cools. Cool-Grinding helps to keep wheel cutting free, permits heavier downfeeds without burning or checking the workpiece and reduces the frequency of wheel dressing because diameters are maintained for longer grinding periods.

You get more output per hour because you don't have to stop to check dimensions . . .

The amount of work produced on a surface grinder depends on whether its feed calibrations represent an equivalent amount of stock removal. To grind, measure and then grind some more to secure final dimension is a costly waste of time.

DoALL takes the guesswork out of surface grinding because the wheel removes stock exactly according to downfeed setting. This reliability does not exist in all surface grinders. An accurate handwheel alone does not make an accurate surface grinder. Nor can accuracy be determined except under the stress of grinding, as illustrated at the left.

For true precision grinding with greatest output per hour, there is nothing to match a DoALL.

ASK FOR A FREE DEMONSTRATION — Compare a DoALL with any surface grinder in your shop. See it in operation on a DoALL demonstration wagon right in your own plant. Call your local DoALL Store or write:

The DoALL Company,
Des Plaines, Illinois

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38 local DoALL Service Stores offer free demonstrations.

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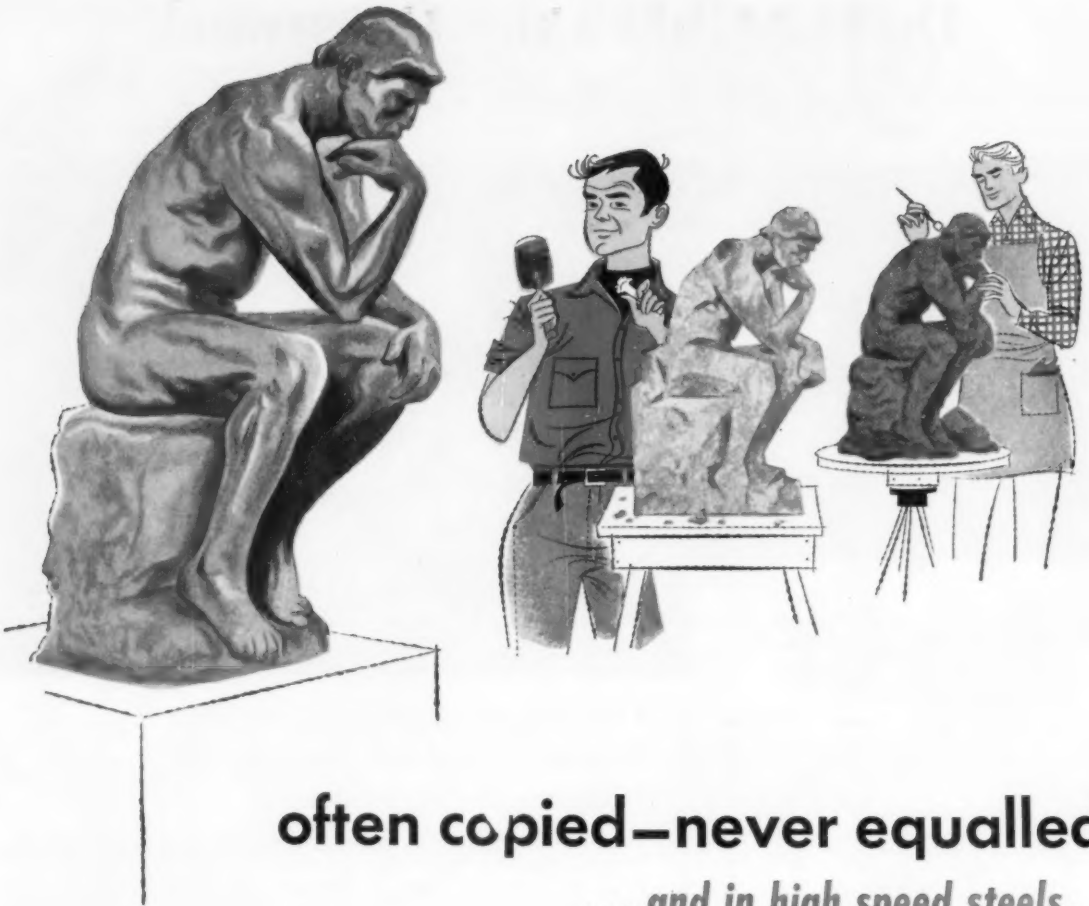
GR-16



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You can get REX from stock from your nearby Crucible warehouse—or promptly by direct mill delivery. For further information on REX and the many other Crucible special purpose steels, send for the *Crucible Publication Catalog*—it's yours for the asking. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

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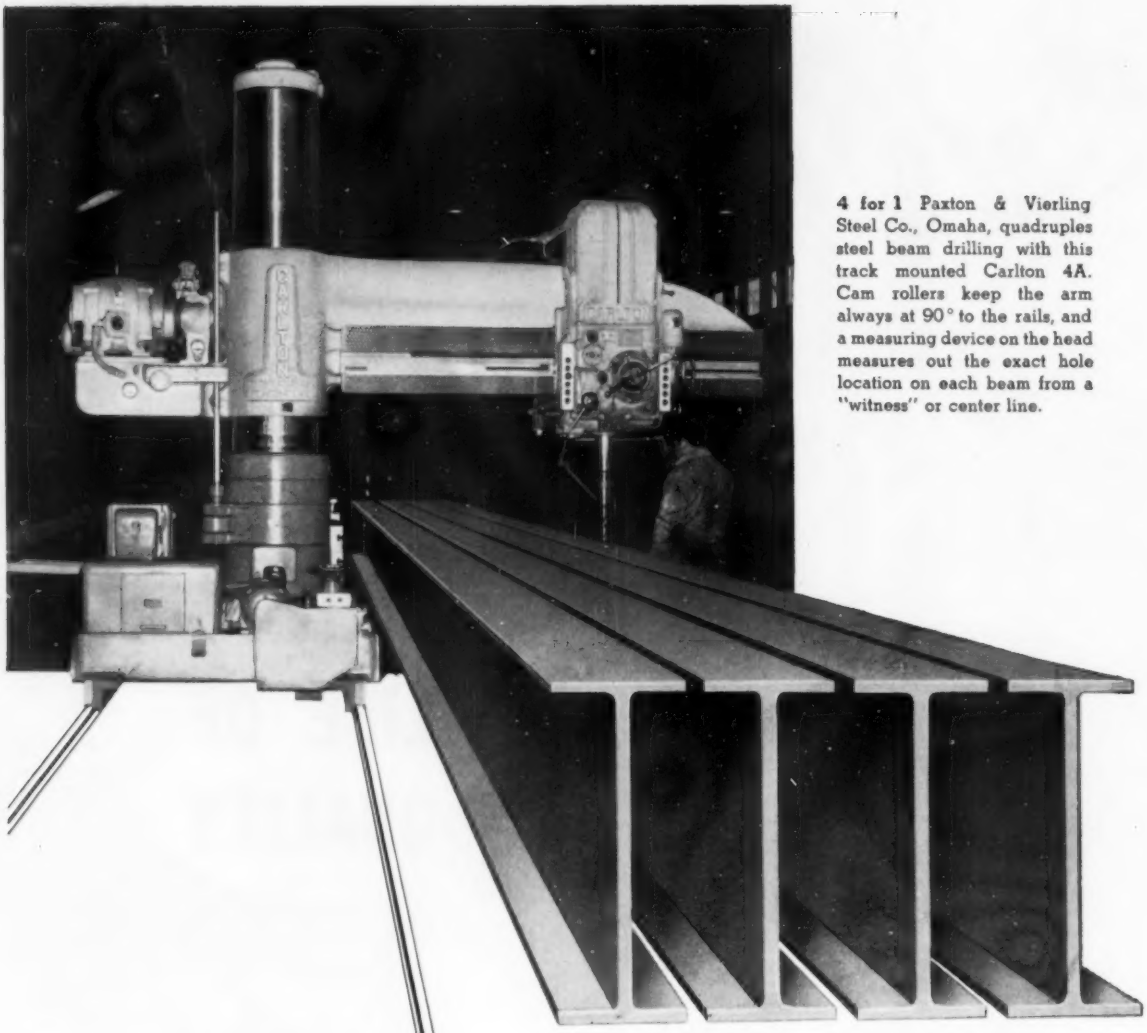


4 for 1 Paxton & Vierling Steel Co., Omaha, quadruples steel beam drilling with this track mounted Carlton 4A. Cam rollers keep the arm always at 90° to the rails, and a measuring device on the head measures out the exact hole location on each beam from a "witness" or center line.

structural steel drilled more efficiently with Carlton track mounted radial drills

Special track mounting takes Carlton's drilling facilities up and down the entire length of even the longest beam. 10-ft. or 100. And Carlton's long arm reaches out over several beams.

Multiple beam drilling is but one advantage of these mobile Carlton radial drills which also offer—at no extra cost: 3-unit power clamping, low-hung drive, positive tooth feed clutch, and easy economical operation and maintenance. Made in five models and many arm and column sizes. Write for descriptive bulletins. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

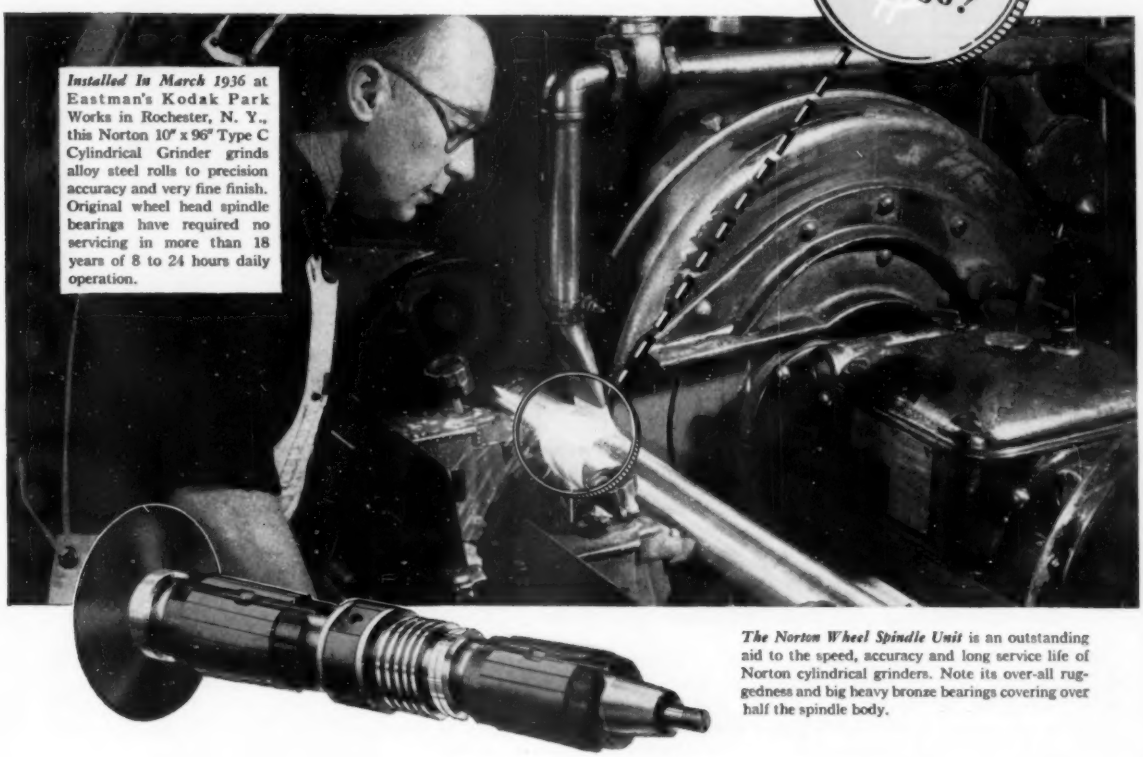
Carlton radial drills in arm lengths 3-ft. to 12-ft., column diameters 9" to 26". Also 4H and 5H horizontals.

Carlton
radial and horizontal drills

How Eastman Kodak gets Extreme accuracy...fine finish... years of trouble-free grinding

Norton wheel spindle a key factor in grinding performance that means...

steady savings!



Installed In March 1936 at Eastman's Kodak Park Works in Rochester, N. Y., this Norton 10" x 96" Type C Cylindrical Grinder grinds alloy steel rolls to precision accuracy and very fine finish. Original wheel head spindle bearings have required no servicing in more than 18 years of 8 to 24 hours daily operation.

The Norton Wheel Spindle Unit is an outstanding aid to the speed, accuracy and long service life of Norton cylindrical grinders. Note its over-all ruggedness and big heavy bronze bearings covering over half the spindle body.

Why are Norton cylindrical grinders so fast and accurate over such a wide range of precision finishing and heavy stock removal jobs?

Why do these hard-working machines last so long, cost so little to maintain?

Advanced features like the Norton wheel spindle unit are the answer. Advantages of this typical Norton development for better, lower cost grinding include:

- *Over 50% of spindle body enclosed in two large heavy-duty, hard bronze bearings for extra long life.*
- *Rugged proportions, and metals toughened by special heat treating, are further aids to long service.*
- *Rigid support over practically the entire spindle surface affords maximum resistance to wheel pressures.*
- *Bearing length of more than twice the diameter increases bearing life.*
- *Automatic flood lubrication of bearings, with flow continually visible through bull's-eyes — an important safety and control feature.*
- *End thrust taken on two large, hardened steel surfaces, also flood lubricated.*
- *Modern precision boring for exact oil clearance keeps lubrication at top efficiency.*
- *Wheel speed changes possible without readjusting bearings.*
- *Extremely low unit pressure, due to long, continuous bearing surfaces, permits fast cutting and enduring accuracy.*

For further facts on how Norton cylindrical grinders can benefit your production, see your Norton Representative. Or write direct for Catalogs. And remember: only Norton offers you such long experience in both grinding wheels and machines to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

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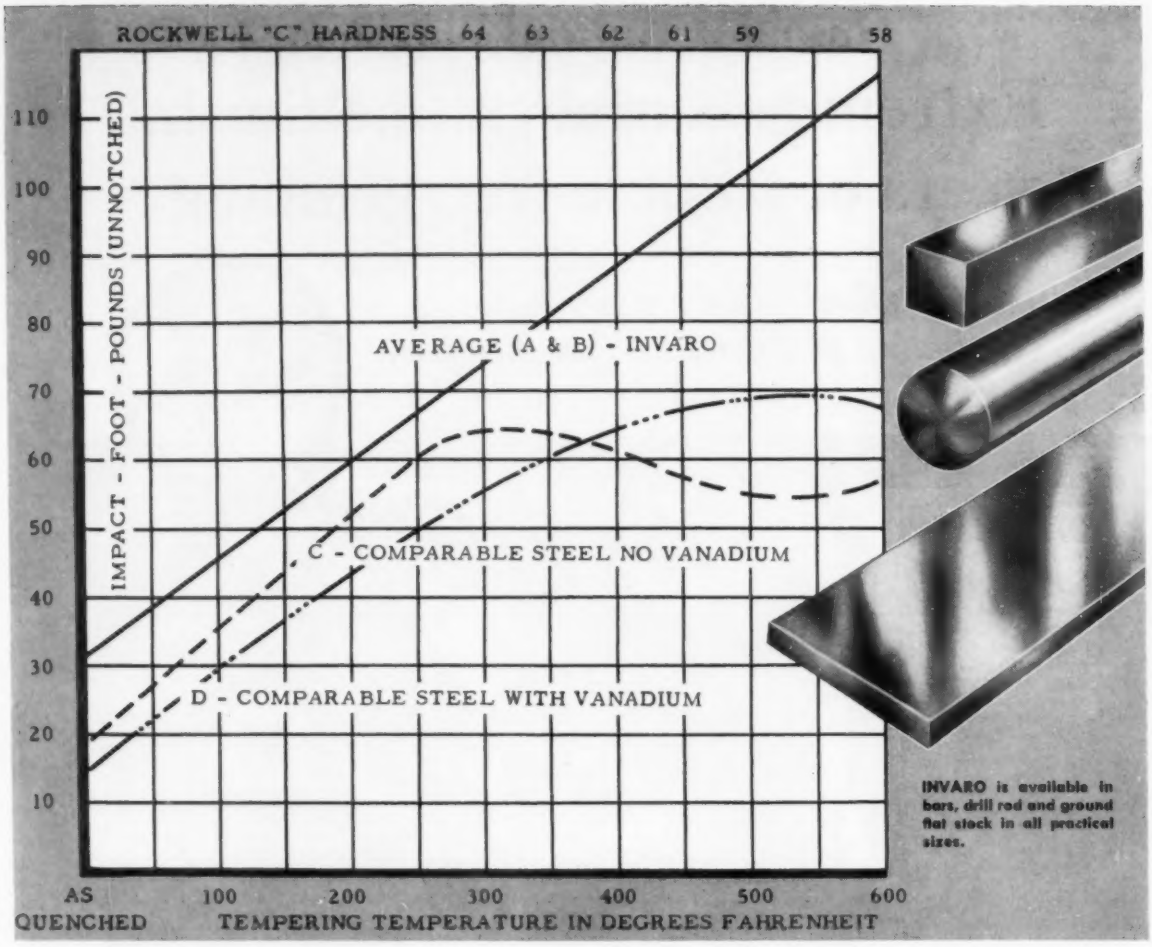

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of leading comparable oil-hardening tool and die steels

When the toughness of a tool and die steel is the critical factor of selection, Firth Sterling INVARO is the *toughest* of the tough! That's not just an opinion but a *fact.* Undeniable proof is established by the A.S.T.M. Izod Impact Test, results of which are graphically shown above, comparing steels both with and without vanadium.

INVARO shows a superior toughness in *all* ranges of temperature from a minimum advantage of about 12% to as much as 100% greater! This marked superiority is the result of Firth Sterling's advanced metallurgical practices combined with 67 years of experience in the art of making specialty steels.

Yes, when you want *toughness* in your tools and dies, combined with uniformity, excellent hardening properties and safety in heat treating . . . specify INVARO.

Chemical Analysis	*All test samples were machined from half-inch annealed bar stock.*							
	C	Si	Mn	S	P	W	V	Cr
Invaro A	.88	.34	1.22	.010	.020	.49	.19	.50
Invaro B	.94	.25	1.20	.014	.013	.53	.22	.49
Comp. C	.90	.33	1.24	.011	.025	.50	—	.55
Comp. D	.95	.34	1.27	.010	.020	.50	.21	.59

Firth Sterling

R-320

—INC—

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High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets
Zirconium

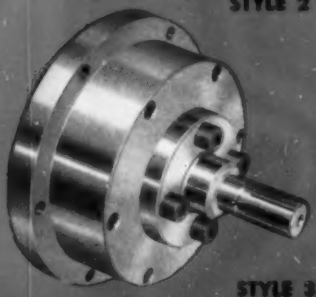
the TORK-LOK DESIGN...

A New Approach to COLLET CHUCKING

PAT. APPLIED FOR

STYLE 1

STYLE 2



STYLE 3

TORK-LOK DESIGN . . . Inclined flats in both collet sleeve and arbor shaft.

GREATER ACCURACY . . . Because flat surfaces are in constant contact on both expansion and contraction.

TORQUE TRANSMISSION . . . Greatly increased by self energizing feature of precision mated flats.

LESS COLLET BREAKAGE . . . Built-in safety stops control both expansion and contraction.

GEOMETRICALLY SEALED . . . Metal-to-metal contact excludes foreign matter thus reducing wear.

SELF-RELEASING . . . Preload feature assures easy part removal.

CONCENTRICITY . . . Locates straight or tapered holes on true center.

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N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD • DETROIT 20, MICHIGAN

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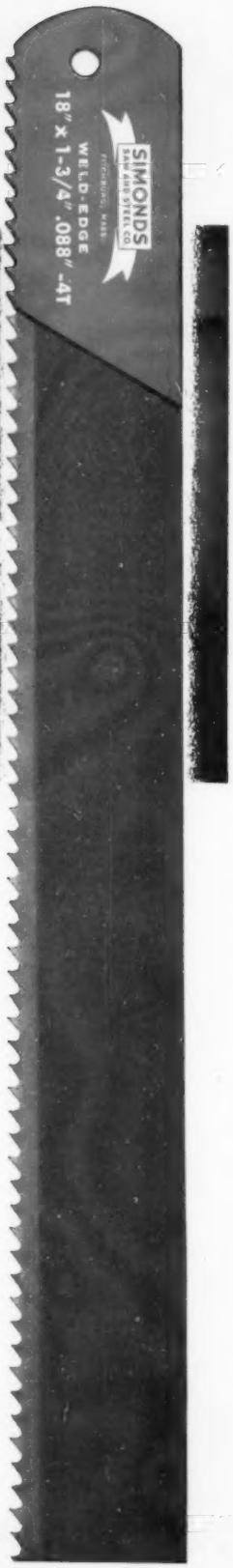
PRECISION INVESTMENT CASTINGS • PRECISION HEAT TREATING OF AIRCRAFT PARTS

SHATTERPROOF...

for Maximum Safety . . . Yet Rigid Enough to Maintain Straight Cutting!



SIMONDS "WELD-EDGE" Power Hacksaw Blade

with The High Speed Steel Cutting Edge

This Simonds-Engineered Blade with its factory-controlled weld is especially designed to meet all plant safety and performance requirements — with real savings in time and cost per cut.

Simonds "Weld-Edge" Hacksaw Blades are *tough* — will not snap in operation regardless of abuse, neglect, machine condition or adjustment. These blades have a High Speed Steel cutting edge that resists wear and is adaptable for all types of cutting.

What's more, "Weld-Edge" Blades have a specially heat treated back that is not only shatterproof but possesses greater rigidity that pays off in straighter cuts and longer life.

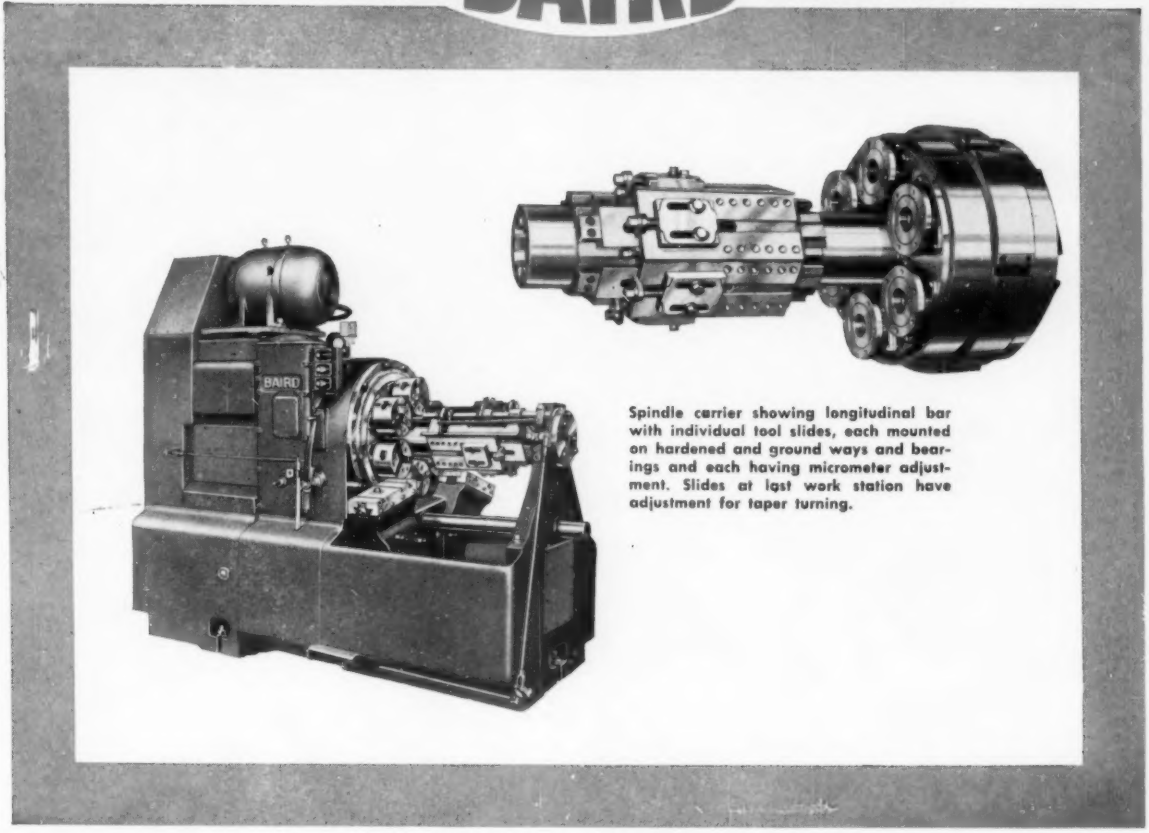
For safety, dependability and increased output at lower cost, ask for SIMONDS "Weld-Edge" — the shatterproof blade with the Red End. All standard sizes available from stock.

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

For Fast Service from Complete Stocks Call your
SIMONDS Industrial Supply DISTRIBUTOR

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon, Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Heller Tool Co., Newcomerstown, Ohio, Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

...ask BAIRD about it



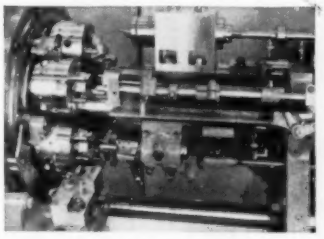
Spindle carrier showing longitudinal bar with individual tool slides, each mounted on hardened and ground ways and bearings and each having micrometer adjustment. Slides at last work station have adjustment for taper turning.

Why the preference for BAIRD Chuckers?

Aside from the fact that the Baird 76-H Chucker has enough outstanding design features and advantages to fill a 12-page brochure (which we will be glad to send you on request), there are two main reasons for its popularity.

One is the unique versatility in tooling provided by an essentially simple, "clean" design which at the same time permits exceptional scope in variety and sequence of operations and cycles . . . including complete automation.

The other is the manner in which Baird Engineering tackles an *individual* customer's problem. Here you get the benefit of our years of work with the nation's top high-production specialists . . . a staff of chucker experts, backed by exceptional tooling and test facilities. When a Baird Chucker reaches the production line, promised performance can be achieved . . . and manitained.



An example of versatile Baird 76-H Chucker tooling for finishing a die cast aluminum end plate, single-indexing, including recessing tool for back-facing . . . high speed boring heads, two-spindle lead screw tapping attachment. Production: 420 pieces per hour.

Our case history files almost certainly contain the start of a profitable answer to YOUR problem in high-speed repetitive production. Before you decide on methods or machines, it will pay you to "Ask Baird About It." Write Dept. TE.

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

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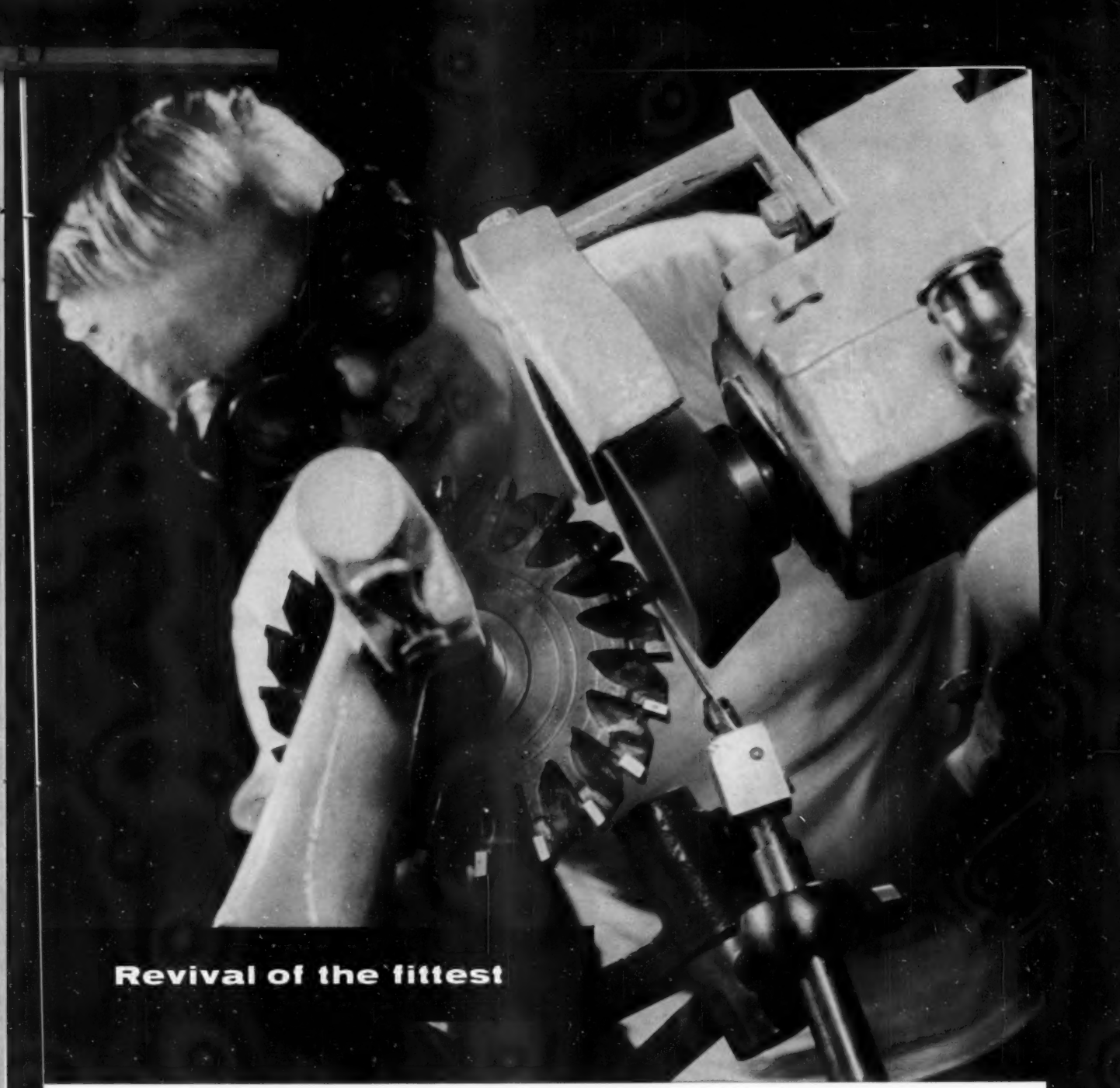

Your best first step in giving dull cemented carbide tools a new lease on life is to select a "Green-Grit" silicon carbide wheel by CARBORUNDUM. For milling cutters and other multiple-point tools, where finer finishes are required, "Green-Grit" resinoid bond wheels offer superior form-holding ability. Even with heavier infeeds, they cut free and cool. In roughing operations, where stock removal is more important than finish, you'll find "Green-Grit" vitrified bond wheels your best bet. They permit both steel and carbide to be ground together—with outstanding results.

Your CARBORUNDUM Distributor or salesman can help you choose the right "Green-Grit" wheel for every job. Call him today. For Booklet A-1208 on carbide grinding, write The Carborundum Co., Niagara Falls, N. Y. In Canada: Canadian Carborundum Co., Ltd., Niagara Falls, Ont.

Through application "know-how" and product quality

CARBORUNDUM

REGISTERED TRADE MARK

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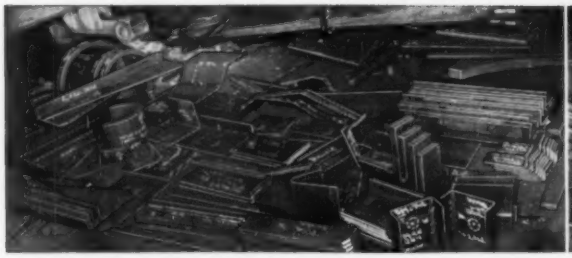
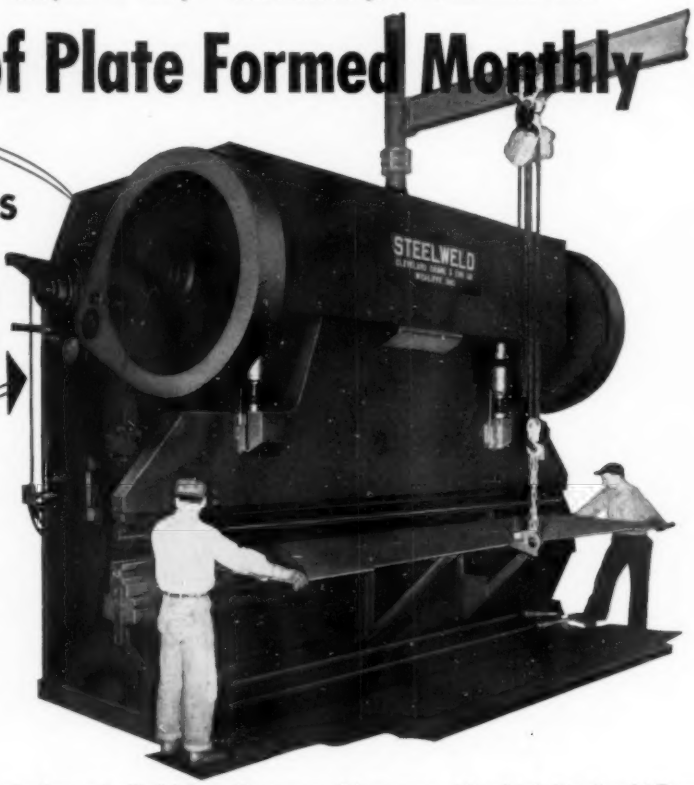


Some of the thousands of varied parts formed on the Steelweld Press. These involve bends and curves of every description in many plate thicknesses.

Bars of heavy cross-section, usually requiring a bulldozer, are formed into semi-circles for gear rims and similar uses.

800 Tons of Plate Formed Monthly

STEELWELD PRESS *Produces* Infinite Variety of Curves and Bends



This Steelweld Press is rated at ½"x14'-0" mild steel. With the 24-inch bed and ram extension at each end, it will bend plate that can clear by the 18-inch deep throat to 18'-6" long. Two cross shafts with foot pedals are provided for operating the press. The lower shaft is for normal operation while the upper shaft brings the reversing flywheel into action to back the ram off the work whenever desired.

EVERY month some 800 tons of plate of all thicknesses to one-half inch is formed with bends and curves of every description on a Steelweld Press. The machine is in operation nine hours a day.

Since parts formed are produced in very small duplicate quantities, the dies and machine settings usually must be changed many times during a day. Because of the ease with which Steelweld Presses can be set up, the operators can do this quickly and easily.

Steelweld Presses offer so many advantages that we urge you to write for the catalog below and get all the facts on them. Hundreds of these machines are now in use for bending, forming and punching operations of every description.

GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

8551 East 281 Street

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BENDING PRESSES

BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

HELLER

American-Swiss®

ROUND HANDLE

NEEDLE FILES

NEW

a complete set in this compact carrying case

FIRM GRIP HANDLE

For die makers and other fine tool makers. Twelve different shapes, each with long knurled handle for firm grip. All are double cut.

SIZE	CUT	WT.
4"*	0, 2, 4, 6	0-2
5½"	0, 2, 4, 6	0-5
6¼"	0, 2, 4, 6	0-8

* In 4" length, Oval is furnished instead of Crossing.

HELLER TOOL CO. TRADE MARK SINCE 1836

Also made in Square Handle Needle (Escapement) 5½" size only—cuts 0-2-4-6

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VIXEN® *American-Swiss*® NUCUT®

FAMOUS BRANDS MADE BY **HELLER TOOL CO.**

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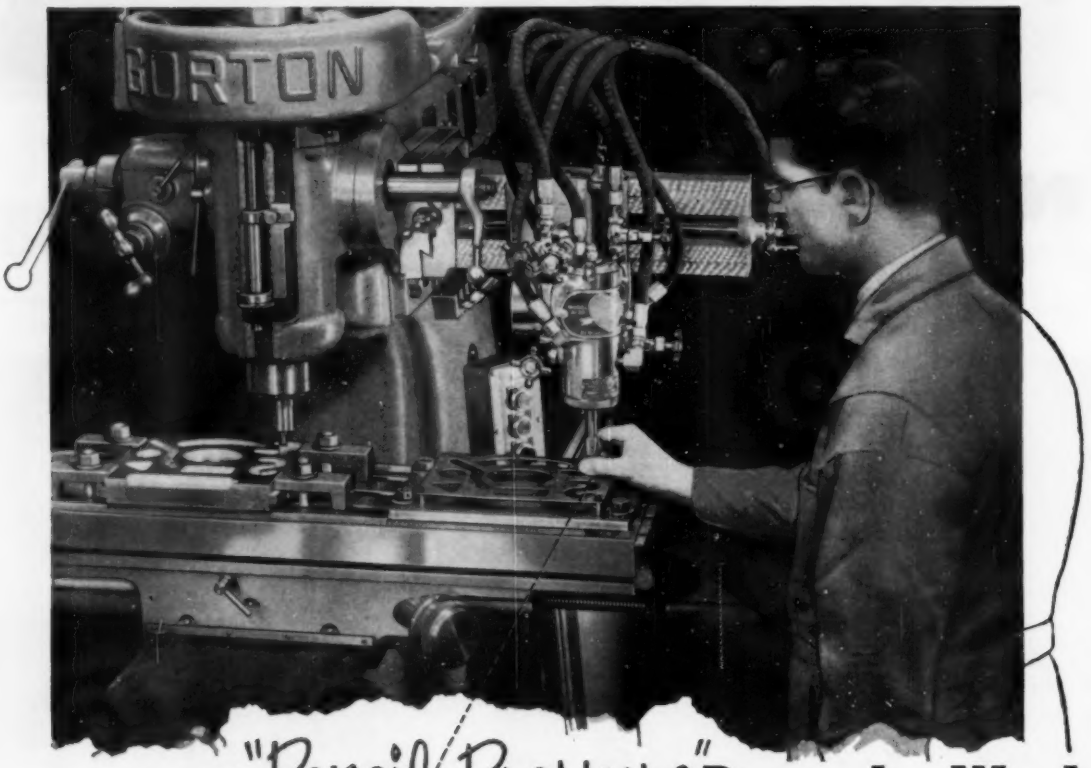
Now... Gorton Milling Machines Feature Hydraulic 3-Dimensional Controls



"Pencil Pressure" Does the Work

Gorton now offers you several models of Super-Speed Vertical Mills equipped with sensitive and accurate hydraulic controls featuring feeds up to 40 inches per minute.

AVAILABLE 3 WAYS

1. **Vertical action only**
2. **Cross and longitudinal**
3. **Three-dimensional combination**

Gorton Milling Machines with hydraulic Tracer Control must be ordered as such. Hydraulic equipment is not an attachment but a permanent installation.

For die or mold work (single or multiple units), production profiling and duplicating — short runs, experimental pieces or high production.

Gorton also offers manual and automatic Tracer-Controlled Milling Machines and Pantographs for 2- or 3-dimensional operation; 1 to 1 ratio, or reproduction at variable reductions, with single or multiple-spindle machines for work of any shape or size.

Shown above: Gorton 9-J Super-Speed Vertical Mill with True-Trace hydraulic installation.

Write for Form 2697-ADS and 2609-1655 General Catalog.

GORTON

SINCE 1893

GEORGE *GORTON* MACHINE CO.

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Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

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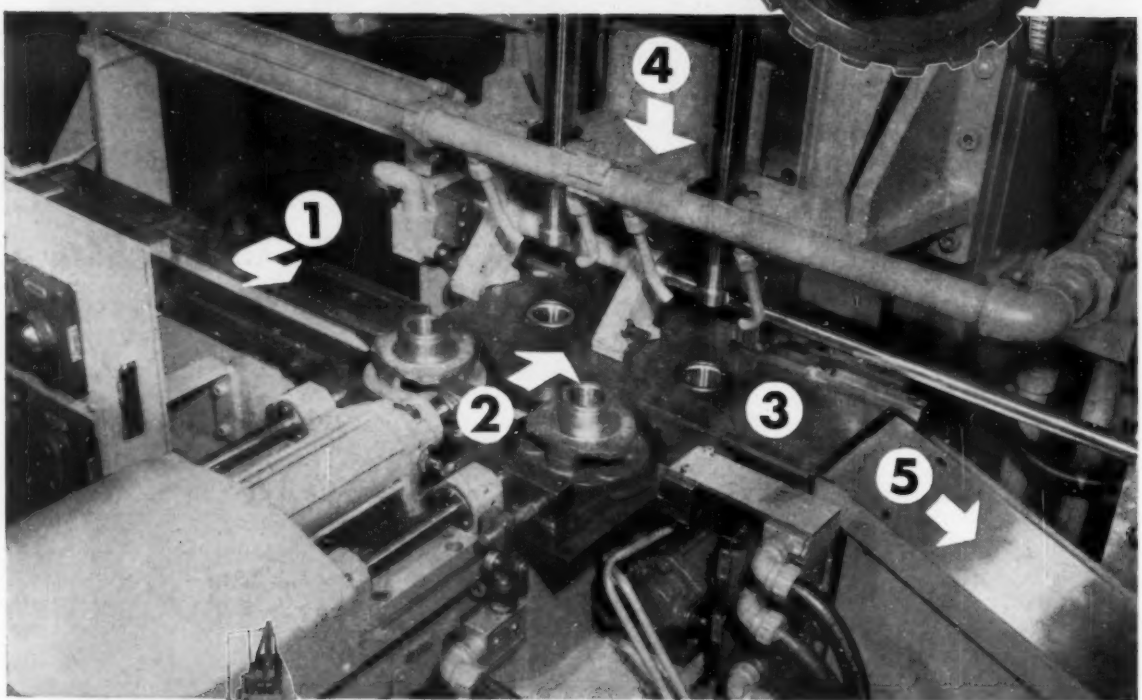
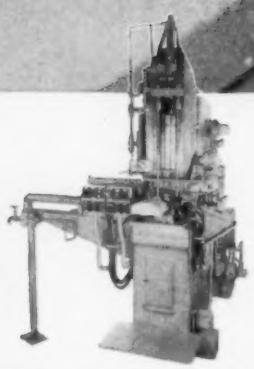
more about **AUTOMATION** by *American*...

SPLINE BROACHING

of transmission part

MADE FULLY AUTOMATIC





Fully automated broaching by American here results in an output of 380 parts per hour (at 100% efficiency). Regardless of what degree of automation you require, American is prepared to design and build the broaching machine, fixtures and broaches that will fit your production picture best. Write details of your requirements today.

1 Hydraulic fixture, interlocked to the machine cycle, transfers parts laterally, two at a time, from conveyor to position in front of the broaches.

2 Hydraulic pusher carries parts into broaching position.

3 An automatic skid plate then lowers and seats the parts over the thrust bushings.

4 Spline broaches, 36" long, are pulled down through the two parts, broaching 35 splines in the ID of the hub.

5 As skid plate rises, unseating the parts, hydraulic plunger ejects the parts down inclined chute.

ASK FOR CATALOG 450

AMERICAN *American* BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

Tool Steel Topics

BETHLEHEM STEEL

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

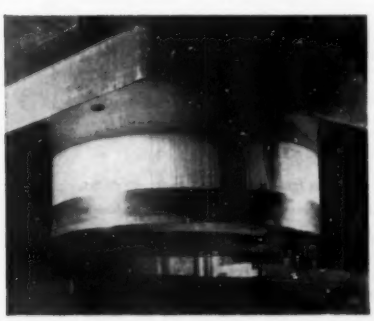
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

Good Results with BTR Hollow-Bar in Manufacture of Fan Housing

Based upon all-around performance — less time spent in machining, good resistance to wear, and ease of heat-treatment — dies of BTR (Bethlehem Tool Room) Hollow-Bar rang the bell recently at Electrolux Corp., Old Greenwich, Conn.; the steel was supplied by Lindquist Steels, Inc., Bridgeport, Conn.

The dies, hardened to approximately Rockwell C 60, and operating in a 100-ton press, formed fan housings from 25-gage zinc-coated sheet steel at the rate of more than 1600 pieces per hour. Redressing was required once every two months or so, and then no more than 0.010 in. was removed.



BTR Hollow-Bar is made from our oil-hardening tool steel by a process called high-speed trepanning. By this method, we take hammer-forged round bars, core the inside diameter, then give them a rough-turning on the outside.

With BTR Hollow-Bar there's no need to run up shop costs waiting for delivery of forged rings or discs. Instead, this fine tool steel comes to you ready to go, with no need for drilling, rough-boring, rough-facing or rough-turning.

Your Bethlehem tool-steel distributor will be glad to explain how BTR Hollow-Bar can be of real service to you. Or a phone call or letter to the nearest Bethlehem sales office will bring you detailed information promptly.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Remove all the "Bark" from Liquid-Quenched Tools

Most users of tool steel realize that it is necessary to remove the "bark" (scaled and decarburized outer surface) from tool-steel bars in order to obtain full, uniform hardness in heat-treatment. If this area is not removed, low hardness will result because of the low carbon content of the decarburized metal. It is not always recognized that this procedure is necessary on tools which are to be liquid quenched, even though portions of the tool do not constitute working surfaces.

If tools are to be liquid quenched, all the bark must be removed to avoid excessively high quenching stresses which could cause cracking of tools during hardening. Low carbon areas on the surface transform during hardening at a different time than the higher carbon interior. This sets up additional stress which, added to the high thermal stresses from quenching, could cause cracking. Air-hardened tools can tolerate bark on non-working areas because of the low hardening stresses in air hardening. But with liquid-quenched tools there are no exceptions — remove all the bark.

TOOL STEEL MOVIE WINS ANOTHER AWARD

"Teamwork," Bethlehem's new motion picture on tool steel, received a second film award, a silver reel symbolic of excellence, at the recent American Film Assembly competition in Chicago.

The 16-mm, 30-minute color film explains the manufacture, quality control and heat-treatment of Bethlehem tool steels. It is available for showings to machinists, heat-treaters, die makers and tool manufacturers. To see the film, write to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.

Whether you are tooling for short or long-run parts

Hi-Den can roll back forming costs

Above: Hi-Den die which has been band-sawed to rough shape, being hand-finished with woodworking tools to required accuracy. Use of Hi-Den can reduce die fabrication and forming costs 50%.

In aircraft and other light metal industries — wherever tooling cost is an important operational consideration — HI-DEN has effected phenomenal savings. Forming, stretch, draw and press-brake dies, Yoder rolls, jigs, fixtures and pressure pads are but a few of the more than 100 successful applications of HI-DEN.

HI-DEN is a laminate of wood veneers impregnated with phenolic resin and compressed under extreme heat and pressure to approximately half its original thickness. The resultant composition — only 1/6 as heavy as steel — is about three times as strong as equal weight of steel yet is easily shaped with standard tungsten carbide tools.

It has high dimensional stability and is virtually impervious to oil and moisture. Used in forming tools, HI-DEN's low coefficient of friction eliminates scratching and burring. HI-DEN treats the metal better and results in far lower scrap.

Our Technical Bulletin and literature show how to get increased production of superior quality products — at lower cost — with HI-DEN. Send for it today.

P.S. HI-DEN'S companion product, Parkwood 8000 (a kraft paper impregnated laminate) is widely used for cutting templates and bench tops. Smooth, hard, but resilient, it won't burr and scratch assemblies of aluminum alloys and other softer metals.

Parkwood Laminates, INC.

32 Water St., Wakefield, Massachusetts

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Standard sizes 00, 0, 2, carried in stock.

We specialize in one thing only... designing and making SCREW MACHINE TOOLS!

45 years experience goes into every tool we make. They come to you ready for use... Precision design... Skilled workmanship... Finest materials.

Our extensive facilities save you TIME... MONEY... and give you accuracy, quality and quick service.

• 45 Years at the Same Address

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Low cost because Kenco presses are quality-built *throughout* to produce at top speed, and with the least downtime you've ever experienced.

Precision stamping—a result of unusually rigid frames... extra long ram guides and slides that permit full use of the guiding area at the bottom of the stroke.

Send for full details on money-saving Kenco presses.

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Mfrs. of Precision Machinery and Accessories.

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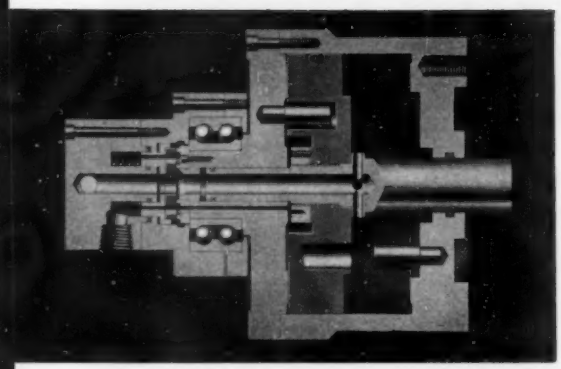
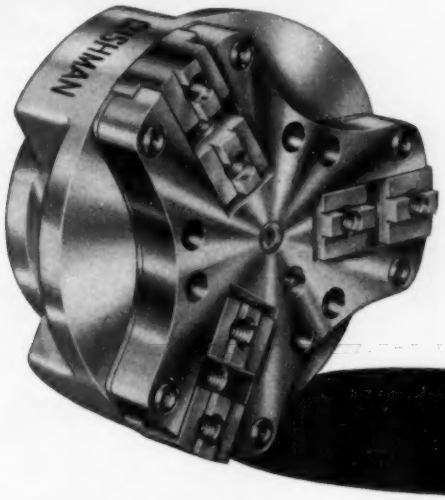
CUSHMAN chucks give Chuck-ability

CHUCK-ABILITY: The ability to SPEED your work . . . ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . .through design and selection of the right work-holding devices.





Typical Cushman Air Operated Chucks and Cylinders for repetitive machining operations permitting increased production at lower costs.

the key to machining efficiency

Today's repetitive manufacturing demands *efficient* and *economical* operation of high speed machine tools. Cushman Air Operated Chucks and Cylinders give you **Chuck-ability** with satisfactory performance under the punishment of constant day-in and day-out service . . . no loss of chuck or cylinder efficiency over a long service life . . . no air leakage problems . . . and the feature of *quick* loading and unloading of workpieces at the touch of foot or hand.

Chuck-ability is available to you in Cushman's complete line of manually and air operated precision chucks, designed and manufactured to meet today's high metal working quotas at lower production costs.

Write today for catalogs fully describing Cushman Chucks. Or, should you have a particular work-holding problem, Cushman can give you **Chuck-ability** in a special chuck, designed and engineered to your requirements.

THE CUSHMAN CHUCK COMPANY • **Hartford 2, Connecticut**

a world standard for precision

CUSHMAN CHUCKS . . . *a Product of American Quality, Labor and Materials.*

CUSHMAN CHUCKMAN CHUCKS 1867

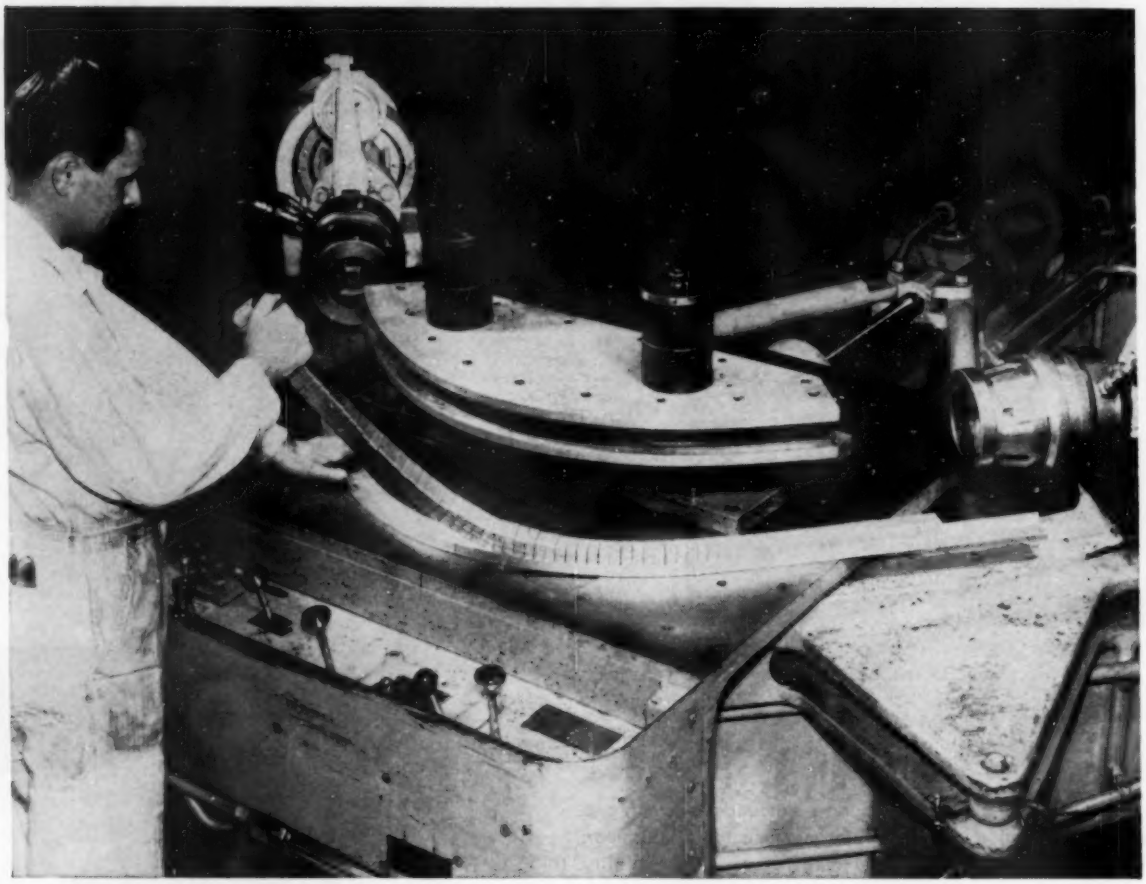
SEE YOUR INDUSTRIAL DISTRIBUTOR

manufacturers of:

Air Operated Chucks, Cylinders, and Accessory Equipment . . . The Cushman Power Wrench . . . Cushman Manually Operated Chucks and Face Plate Jaws.

Made with MAGNESIUM for better stretch-forming.

DOW



TO THE RESCUE! Magnesium snake and tooling plate stretch-forming die has eliminated a lot of headaches for Hufford Machine Works, Redondo Beach, California. Galling, which causes scratching and excessive wear in stretch-forming aluminum extrusions, is no longer a problem since the company switched to magnesium dies. Something else, too—tool costs were cut 20%!

NO GALLING PROBLEM HERE!

Magnesium tooling plate solves this problem in stretch-forming aluminum

Latest development in stretch-forming — magnesium tooling plate. The number one reason is that magnesium's fine-grain, porosity-free structure and better slippage reduce galling to practically *nothing*.

Hufford Machine Works recently substituted dies made of magnesium tooling plate for the steel and aluminum ones they had been previously using. The result: the magnesium dies ran 500 pieces without showing wear and the aluminum extrusions showed no scratch marks!

There are other advantages to magnesium tooling plate. Light weight—one-fourth that of steel, one-third less than aluminum—makes magnesium dies much easier to handle and use. Excellent rigidity, strength and dimensional stability are also magnesium characteristics . . . as well as outstanding machinability and weldability.

Ready availability and lower prices complete the magnesium tooling plate picture. It's a picture you should look into to solve your own tooling problems! For more information about magnesium tooling plate contact your nearest supplier of Dow magnesium, or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 369L-2.

AVAILABLE FROM STOCK AT: Copper and Brass Sales, Inc., Detroit, Mich. • Fullerton Steel and Wire Company, Chicago, Ill. • Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Company, Los Angeles, Calif. • Vinson Steel and Aluminum Co., Dallas, Texas.

you can depend on DOW MAGNESIUM

DOW

STABLE ACCURACY

THE MOST IMPORTANT REQUIREMENT IN GAGING

The basic design of the Dimensionair is different from that of any other Air Gage. It "repeats" measurements precisely and constantly hour after hour because —

1. The Dimensionair's balanced air system *cancels out pressure variations* which might affect it and cause errors.

2. Unlike other air gages, there is no adjustment in the magnifying-measuring side of the system. Rather than introduce a variable here which would make a fixed system impossible, Federal offers two magnifications which answer practically every requirement. These magnifications are 2500 to 1 and 5000 to 1. In this way, *Federal achieves a stability which cannot be approached by other air gages.*

3. Because the magnification is fixed, the *scale is linear* and the graduations can be accurately calibrated.

4. Hence, with no adjustment to change the magnification and affect the stability, only a single master is required.

Try It!

Check a Dimensionair yourself right in your own plant. Compare it with your present air gages.

a. **Check it for stability** or "repetition". Do this frequently and over long intervals, always using the same master. Avoid temperature effects (excessive handling, direct sunlight, etc.). Notice how quickly you can set the gage to zero.

b. **Check its calibration** using any number of masters. Confirm the fact that only one master is needed. See how dependable the Dimensionair really is.

Ask us or our salesmen to let you try a Dimensionair

Federal Products Corporation
6199 Eddy Street, Providence 1, R. I.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .
Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

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horizontal optical jig borer

with 5 optical microscopes

DESIGNED AND BUILT FOR:

VERSATILITY
Optical settings for operations in all planes and compound angles . . . Equally suitable for tooling, short-run or production work . . .

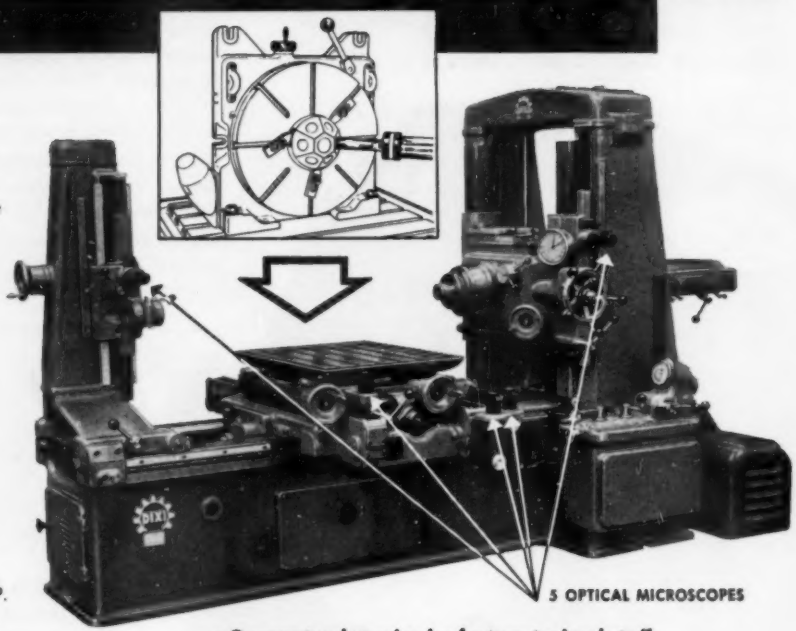
ACCURACY
Overall accuracy of .0002"

A precision machine for *JIGLESS* boring, facing, milling, and drilling work, in all planes. Built-in 360° optical rotary table, 28¾" x 32⅝". All spindle and table settings by optical microscopes. Infinitely variable hydraulic feeds. Mechanical spindle feeds with automatic depth stop. #40 taper spindle-speeds infinitely variable to 1400 R.P.M. Special features eliminate effect of spindle overhang on accuracy.

DIXI 450 PRECISION OPTICAL CIRCULAR DIVIDING TABLE

Direct readings of 1 sec.

(See insert picture above) rigidly mounted (not tilting) on built-in rotary table permits holding close tolerance relations between bores in all planes, including bores at compound angles. ALL IN ONE SET-UP. All sides of the work piece except the mounting face machined in one set-up.



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With the Station Type Machine, Footburt continues to provide the most modern developments in production machinery.

Drilling, reaming, tapping, milling, checking and testing may be combined in one station type machine, and units may be mounted at any angle.

Installations of Footburt Station Type Machines have been made in many leading automotive plants, in some case handling the major machining on the block and head components.

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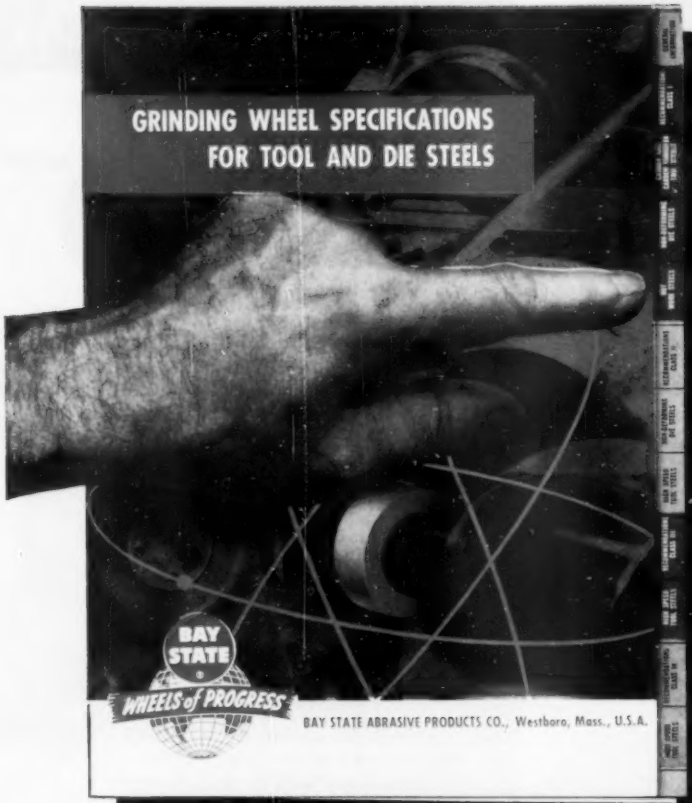
Detroit Office: General Motors Building

19 Station — 115 Spindle
Drilling and Milling Machine

engineered for production

FOOTBURT

MACHINE TOOLS


GRINDING WHEEL SPECIFICATIONS
FOR TOOL AND DIE STEELS
BAY STATE
WHEELS of PROGRESS
BAY STATE ABRASIVE PRODUCTS CO., Westboro, Mass., U.S.A.

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No Bell-Mouth HOLES!

Glenco Floating TOOL HOLDERS

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On new machines they reduce the causes of misalignment — on older and worn machines they correct it.

Increase Production by Reducing Rejects!

You be the judge. Try any stock Glenco 30 days under your shop conditions. Return it if you wish.

Write for Index Folder J.

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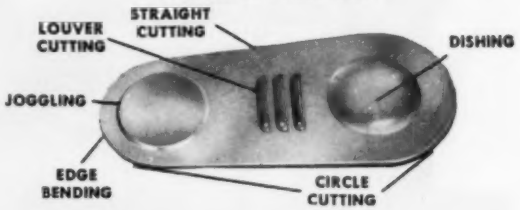
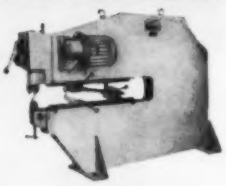
PULLMAX METALWORKING IDEAS

This safety guard for a chain drive made complete on a PULLMAX

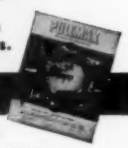


Pullmax machines have the versatility to do all of the metalworking jobs in your Model Shop, Engineering or Maintenance Departments.

One machine does straight shearing, inside or outside circle cutting, design cutting, inside square cutting, beading, joggling, slot cutting, louver cutting, dishing, edge bending and flanging. Seven sizes of machines cut up to 11/4" in mild steel. Ask for a demonstration.



Write for the Pullmax Catalog on Money-Saving Metalworking Ideas.



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DE-STA-CO Clamp-Omatic
AIR OPERATED
TOGGLE CLAMP

for Positive Split-Second Multiple Clamping

MODEL 810-U
12" Long
5 5/8" High
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Available also, Model 810-S— with Solid Bar

- MORE RUGGED
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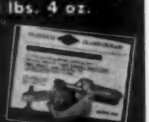
Holding Pressure to 750 Pounds with Normal Air Line Pressure of 90 Pounds. Weight 4 lbs. 4 oz.



Write today for Literature on these NEW DE-STA-CO CLAMP-OMATICS— Models 810-U and 810-S

DE-STA-CO DETROIT STAMPING COMPANY
WORLD'S FIRST LINE OF TOGGLE CLAMPS
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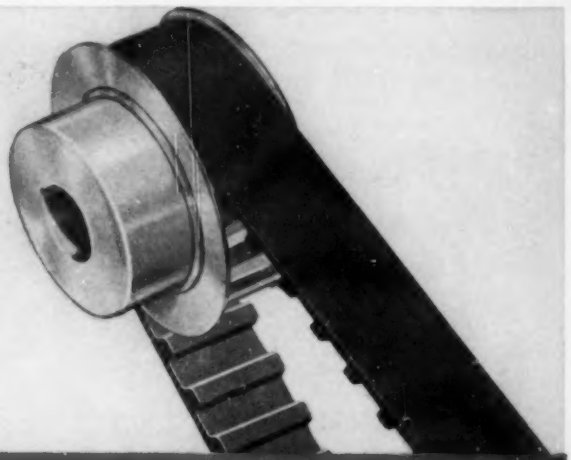
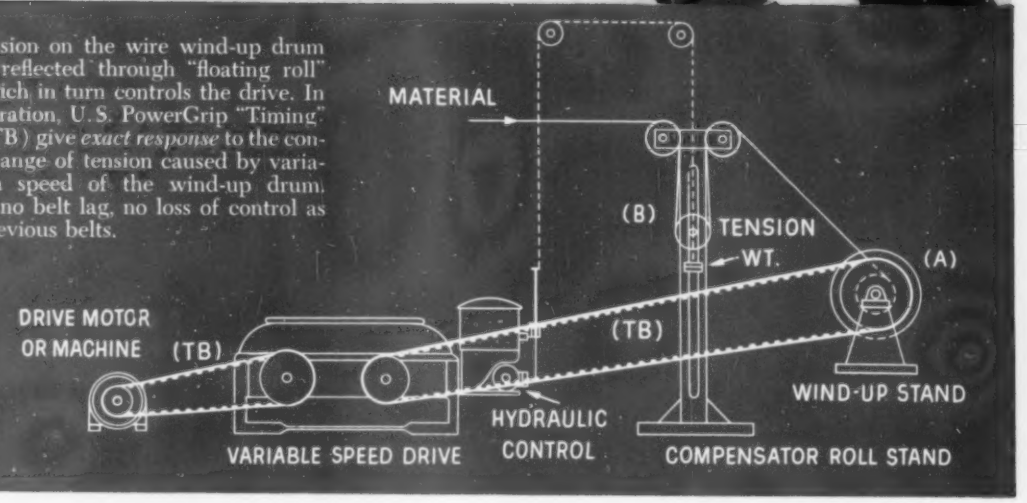
US RUBBER PowerGrip "Timing" Belts

How a designer licked the wind-up problem in a highly sensitive machine



The tension on the wire wind-up drum (A) is reflected through "floating roll" (B) which in turn controls the drive. In this operation, U.S. PowerGrip "Timing" Belts (TB) give *exact response* to the constant change of tension caused by variations in speed of the wind-up drum. Hence, no belt lag, no loss of control as with previous belts.



The schematic drawing illustrates a "floating roll," one of the most sensitive and precise methods of controlling tension in a web of material—whether it be wire, paper, cotton, threads, plastic or strips of metal. It is one more example of U.S. PowerGrip "Timing"® Belt's ability to simplify and improve a power transmission unit . . . one of the reasons why the invention of this belt was recently awarded the Franklin Institute's Edward Longstreth Medal for "Invention of High Order."

Whether for original equipment or plant conversion, U.S. PowerGrip offers all these advantages:

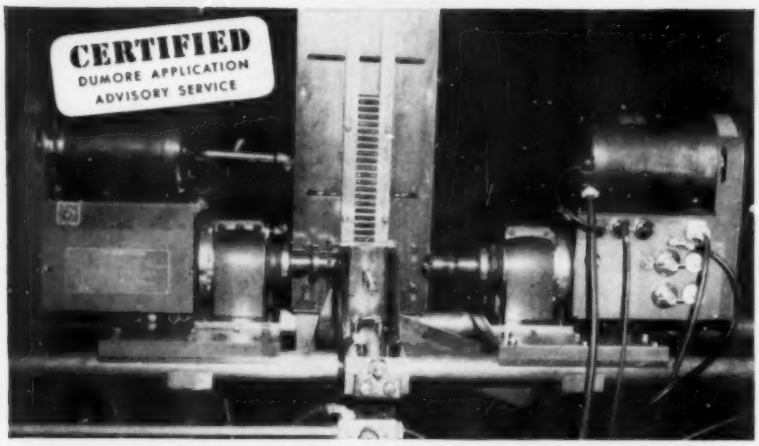
- *no slippage, no take-up—allows short centers, high ratios.*
- *absence of metal-to-metal contact—eliminates need for lubrication and housing devices.*
- *handles speeds up to 16,000 F.P.M. or so slow as to be imperceptible to the eye.*
- *close to 100% efficiency.*
- *imbedded with steel cables for high tensile strength.*
- *constant angular velocity.*

These belts—plus expert engineering service—are obtainable at "U.S." power transmission distributors, at any of the 28 "U.S." District Offices, or by writing us at Rockefeller Center, New York 20, N. Y.

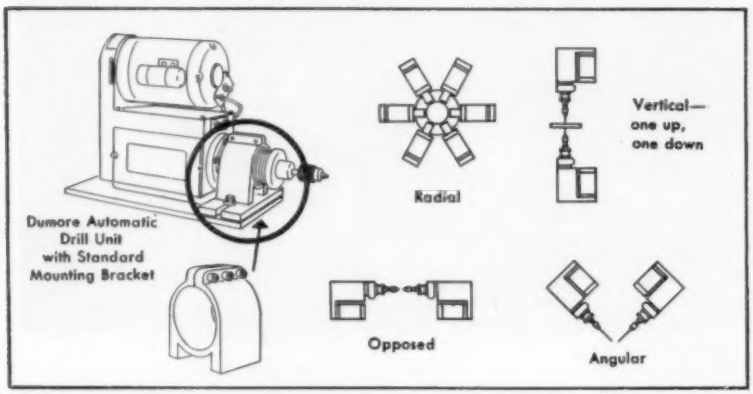
US RUBBER **Mechanical Goods Division**

United States Rubber

Facing-Deburring Job Speeded Up 300% with Versatile DUMORE Automatic Drill Units



This "Special" Machine, constructed from standard parts, faces and deburrs four times as many steel pipe sections as the previous method. As each part falls from the hopper to the fixture, an automatic switch actuates a clamping device to hold the part. The two Dumore Automatic Drill Units, also actuated, advance, face and deburr the ends simultaneously, and retract to starting position—all automatically.



Key to Simplicity of the Dumore Automatic Drill Unit is the standard mounting bracket which permits quick removal and transfer of Dumore Units to other shop operations. These low cost brackets quickly adapt Dumore units...at any angle...to existing shop equipment. Dumores are delivered complete and ready to be used. All controls, electrical and pneumatic are built in.

Star Tubular Products Co. of Chicago wanted to step-up production of their welded steel pipe sections. A major stumbling block was the slow job of facing and deburring both ends of each section. The process required handling each part three times: facing and deburring one end, removing and reversing the part, facing and deburring the other end. Output was 135 pipe nipples per hour. Dumore was asked to find a better, faster method.

Technical Application Aid

Dumore's Application Advisory Service recommended a set-up that resulted in the machine pictured at the left: two Automatic Drill Units opposing each other with a hopper feed for the pipe sections in the center. As each pipe section falls into the fixture, it actuates the Automatic Drill Units which move in and face and deburr each end simultaneously, retract to starting position, actuate work feed and advance again—all automatically.

Production Goes Up

The set-up, as simple and inexpensive as it was, boosted production to 500 parts per hour—a 300% increase. In addition, the accuracy of this finishing process permitted the company to roll-cut their tubing, instead of square cutting, reducing the cut-off operation time by 300%!

The "multiple-use" value of Dumore Automatic Drill Units is still another benefit the customer gets. Its unique, simple mounting feature permits it to be quickly transferred and re-used for drilling, tapping, reaming and related operations throughout the shop, paying for itself over and over again.

SEE YOUR DUMORE DISTRIBUTOR

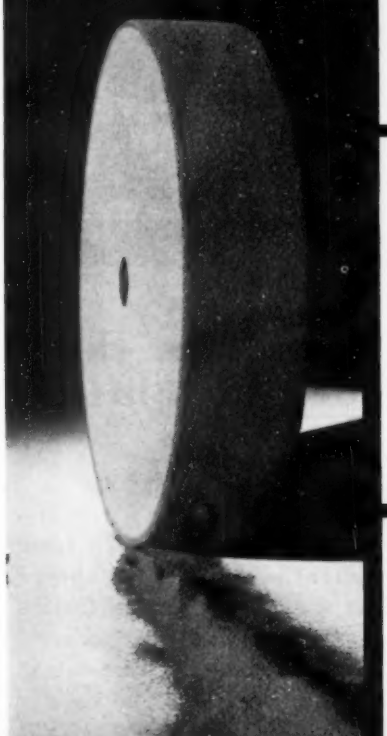
DUMORE®

AUTOMATIC DRILL UNITS
TOOL POST AND HAND GRINDERS

1310 Seventeenth St., Racine, Wisconsin

Let Dumore's Application Advisory Service help you get increased production and lower costs on jobs like this. Write for FREE Dumore Application Analysis Kit.

You polish with the "Touch of Gold" when your wheels or belts are coated with ALUNDUM B abrasive. This extremely hard, sharp grain cuts fast, clean and cool. And the Norton special high capillarity treatment means easier wetting with cement or glue — for maximum adhesion, longer wheel life and better polishing performance.



Norton ALUNDUM B abrasive consists of grains of uniform blocky shape. No flats, slivers or undersize grains to loaf on the job. No oversize grains to mar surfaces. Made in all grit sizes, from 20 through 240, to cover the widest range of polishing operations.

More, and better, polishing with every set-up

ALUNDUM* B abrasive brings the cost-cutting, value-adding "TOUCH OF GOLD"

Ask Your Norton Distributor for the booklet "Setting Up Metal Polishing Wheels and Belts." Or write to the nearest district office of NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., div. of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

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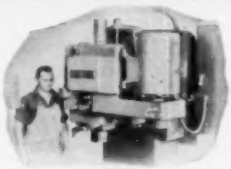
From Elements Like These

Together with SUNDSTRAND "Engineered Production"

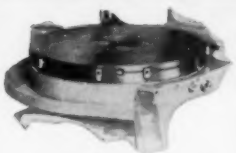
TRAVELING HEADS

Self-contained units with ways for horizontal or angular travel.



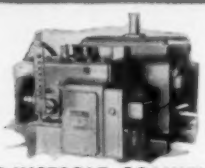
VERTICAL OR HORIZONTAL HEADS

Available in capacities from 3 to 100 H.P.



ROTARY TABLES

Available in several sizes for continuous or rotary milling operations.



ADJUSTABLE COLUMNS

Movable columns provide maximum cutting rigidity for horizontal heads over a wider range for milling both large and small work pieces.

HORIZONTAL TABLES

Available in widths from 10½" to 96" and feed strokes from 18" to 216".

ALL ANGLE HEAD

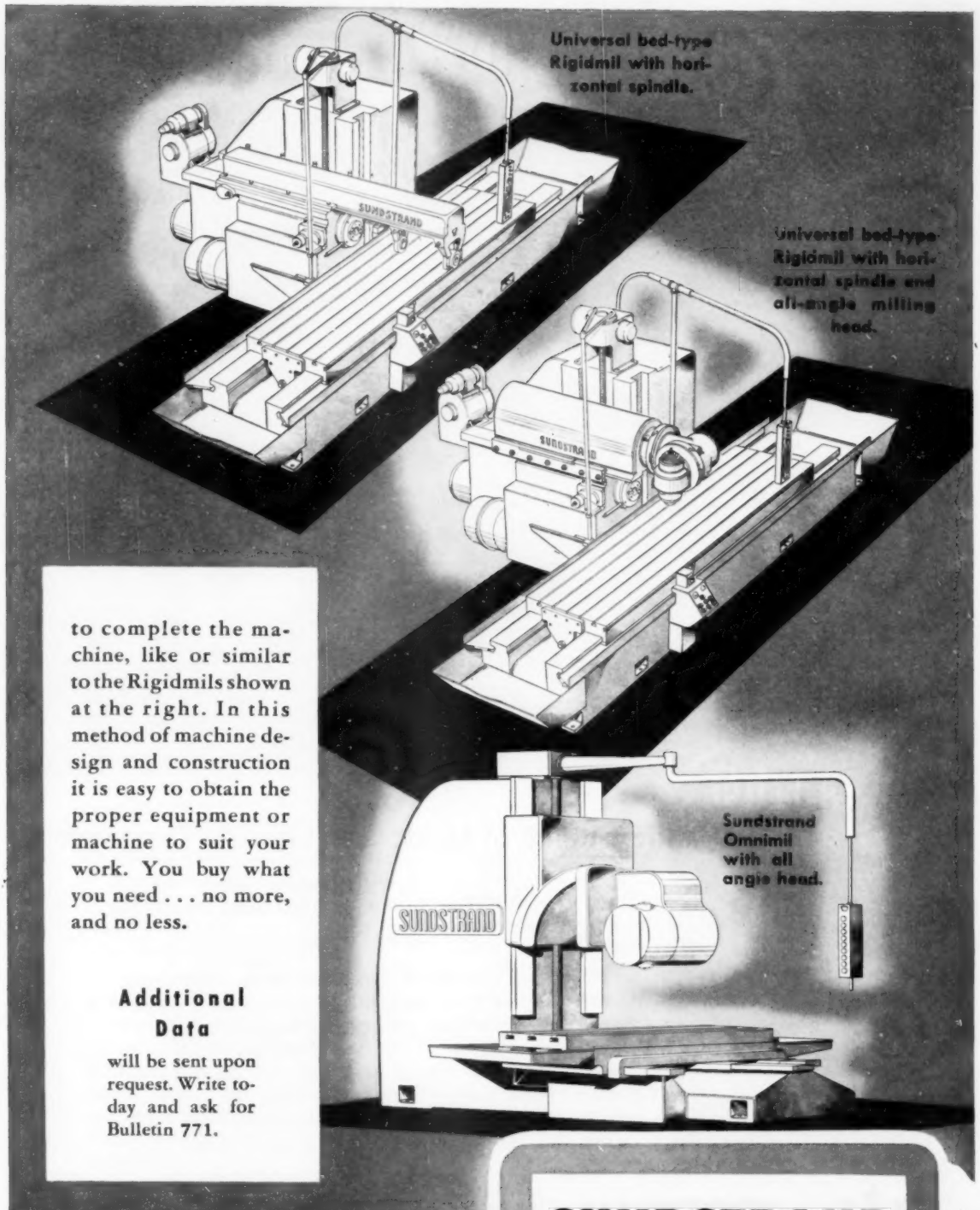
Available up to 25 H.P.

...You'll get the exact machine for your requirements

Sundstrand Rigidmils are built from standard machine elements as shown above. After the correct tooling for the job has been determined, the proper combination of machine elements is assembled

SUNDSTRAND "Engineered Production" Service* *REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

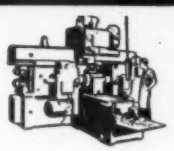

Universal bed-type Rigidmil with horizontal spindle.
Universal bed-type Rigidmil with horizontal spindle and all-angle milling head.
Sundstrand Omnimil with all angle head.
SUNDSTRAND

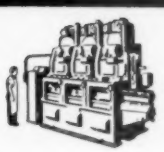
to complete the machine, like or similar to the Rigidmils shown at the right. In this method of machine design and construction it is easy to obtain the proper equipment or machine to suit your work. You buy what you need . . . no more, and no less.

Additional Data

will be sent upon request. Write today and ask for Bulletin 771.

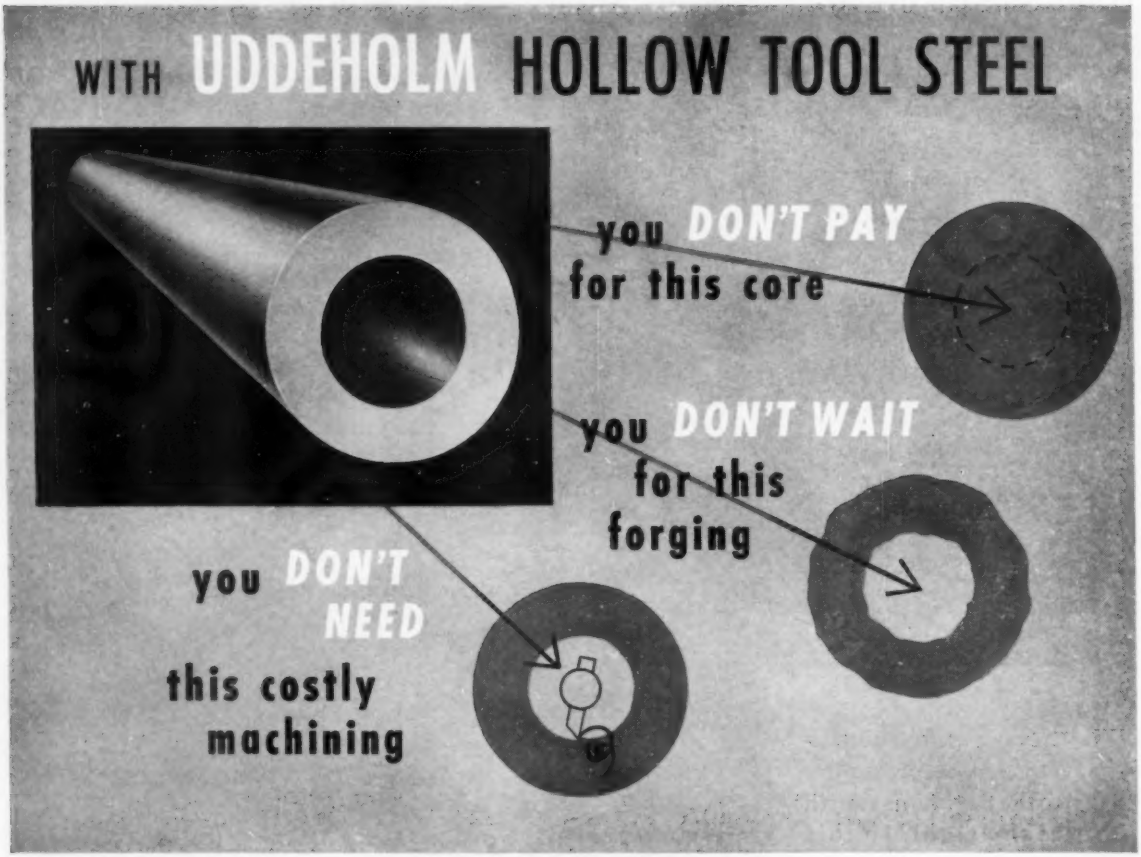
TRIPLEX RIGIDMILS | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2540 Eleventh St. • Rockford, Ill., U.S.A.

WITH UDDEHOLM HOLLOW TOOL STEEL



FAST DELIVERY

A Wide Choice of Inside and Outside Diameters

This convenient form of quality tool steel is providing tool engineers—and all the metal-working industry—with substantial savings in costs and production time. It does away with drilling, boring, cutting off and rough facing operations—eliminates scrap losses. Steel for draw dies, ring gages, collets and other ring-shaped parts comes with the center *already removed*. Whether you need an inch or a ten-foot bar, quick delivery on Uddeholm's hollow bar tool steel is as simple as picking up the phone. Warehouse stocks are always ample.

AVAILABLE IN THESE GRADES AND SIZES

UHB-46 OIL HARDENING
Outside Diameter, 2″–16″
Inside Diameter, 1″–12″

TRI-MO AIR HARDENING
Outside Diameter, 3″–16″
Inside Diameter, 1″–10″

UHB-EXTRA WATER HARDENING
Outside Diameter, 2″–16″
Inside Diameter, 1″–12″

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Specialty Strip Steels

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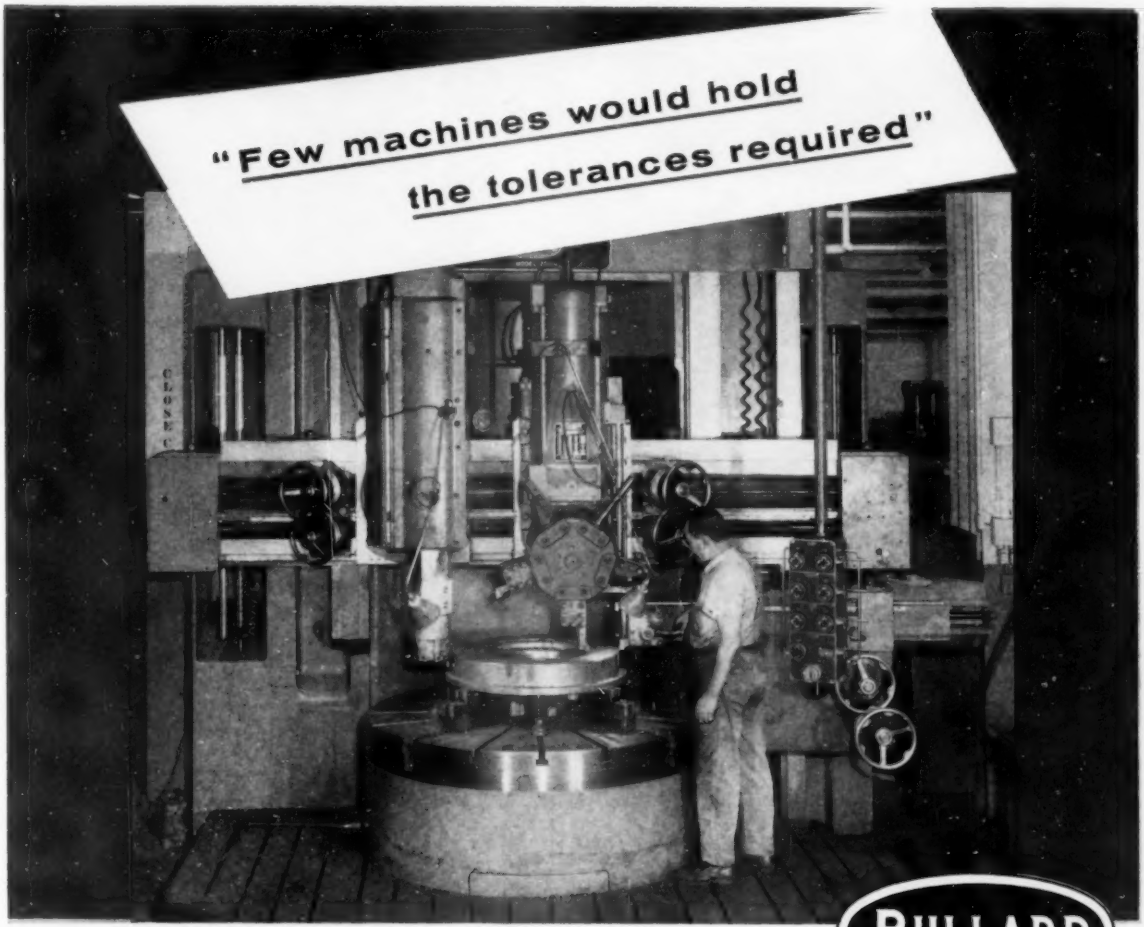
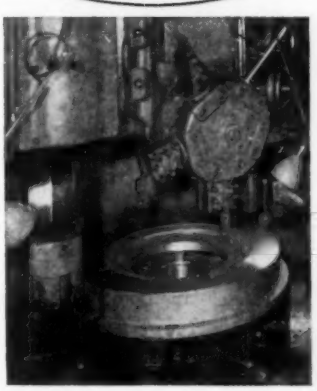
35 Coronet Road, Toronto 18, BElmont 3-3235



This statement by Mr. R. P. Feiser, Industrial Engineer of the York Corporation, York, Pa., is one of the reasons for their purchase of a 66″ Cut Master, V.T.L., Model 75 for the machining of a rotor support for their turbomatic compresesor.

Mr. Feiser further states that "the 66″ Cut Master does this machining at a saving of 40% over any previously used machine. In addition, the pendant control and power swiveling turret head are a great convenience in operation — the result is a low operator fatigue factor. Also, the York Corporation has experienced low maintenance costs on a 60″ Vertical in operation since 1928 and a 36″ Vertical in operation since 1937."



How about You?

Are you employing these same advantages to your machining problems? If not, may we recommend that you get the complete Cut Master V.T.L., Model 75 story by calling your nearest Bullard Sales Office, Distributor or writing for a catalog to

THE BULLARD COMPANY
BRIDGEPORT 2, CONN.

Gardner-Denver . . . Serving the World's Basic Industries

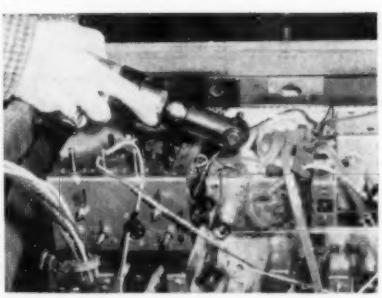
Operator fastens printed circuit assembly to color television chassis—with Keller Tool screw driver.

Keller air tools add the magic touch

Fastenings go into place zip . . . zip . . . zip—when operators use fast-acting Keller Tool screw drivers and nut setters. The pace keeps up throughout the shift—without undue fatigue.

Interchangeable Keller Tool attachments keep up promptly with production line changes. Positive or cushioned clutches. Straight or angle tips. Plus a wide variety of finders, bits and sockets—with magnetic, pneumatic or mechanical pickup and holding devices.

Bulletin 13 gives full information on Keller Tool pneumatic screw drivers and nut setters. Write us today.



Keller Tool right-angle nut setter speeds final assembly of the chassis in color TV cabinet.

GARDNER - DENVER

KELLER TOOL division, Grand Haven, Michigan

THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

BURR-BIT

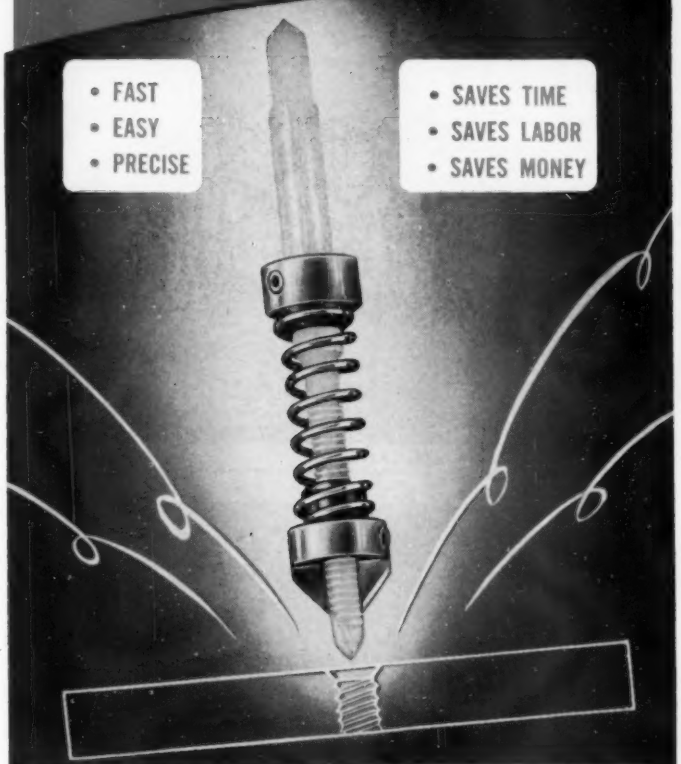
PATENT PENDING

ELIMINATE a Complete Operation!

DE-BURRS TAPPED HOLE WHILE TAPPING

- FAST
- EASY
- PRECISE

- SAVES TIME
- SAVES LABOR
- SAVES MONEY



DE-BURRING WHILE TAPPING

By merely slipping a BURR-BIT on your tap in a matter of seconds, a complete secondary operation is eliminated. Designed to fit all makes of taps.

ELIMINATE A SPINDLE

Save the wasted cost of an extra machine, extra floor space, extra manpower, extra engineering.

GET A PERFECTLY CLEAN HOLE

Since the BURR-BIT removes the burr while the tap is being withdrawn from the hole, the BURR-BIT leaves a smooth finish and removes only the first thread which creates the burr. Does not push the burr back into the hole to spoil the lead of the thread. Permits easy screw insertion.

DE-BURR THIN MATERIAL

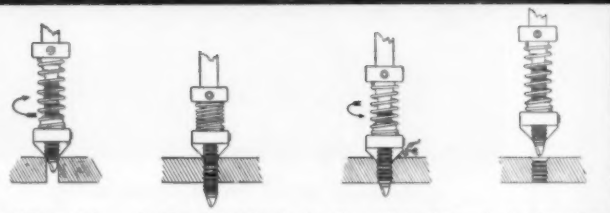
The BURR-BIT creates a chamfer just deep enough to remove the burr and does not spoil the few remaining threads. It gives a smooth, flat surface to the workpiece.

CAN BE EFFICIENTLY USED ON PRACTICALLY ALL MATERIALS—STEEL, ALUMINUM, PLASTICS, ETC.

MADE PRESENTLY TO FIT ALL TWO AND FOUR FLUTED TAPS FROM #2 TO 5/16ths IN ALL PITCHES. AVAILABLE FOR THREE FLUTED TAPS ON SPECIAL ORDER.

BLADES MADE EXTRA LONG TO ENABLE RESHARPENING MANY TIMES.

THE SENSATIONAL BURR-BIT IS A HIGHLY PRECISE PRODUCT MADE OF THE FINEST QUALITY HIGH SPEED STEEL, INDIVIDUALLY INSPECTED.



1. Entering into tap hole-BURR-BIT does not operate.
2. Threading finished. Spring exerts cutting pressure on BURR-BIT.
3. Tap withdrawing. BURR-BIT now deburrs.
4. Leaving clean chamfer.

The Most Economical Method

For high speed production there is no better method for economy of operation. Save labor, time and money this fast, easy way.

VERNON DEVICES, INC.

481 East 3rd Street, • Mt. Vernon, N. Y.

To Receive Full Information
ATTACH THIS COUPON TO YOUR LETTERHEAD

VERNON DEVICES, INC. Dept. T-9
481 East 3rd Street, Mt. Vernon, N. Y.

Please send me full information and specifications on the BURR-BIT.

Your Name .....

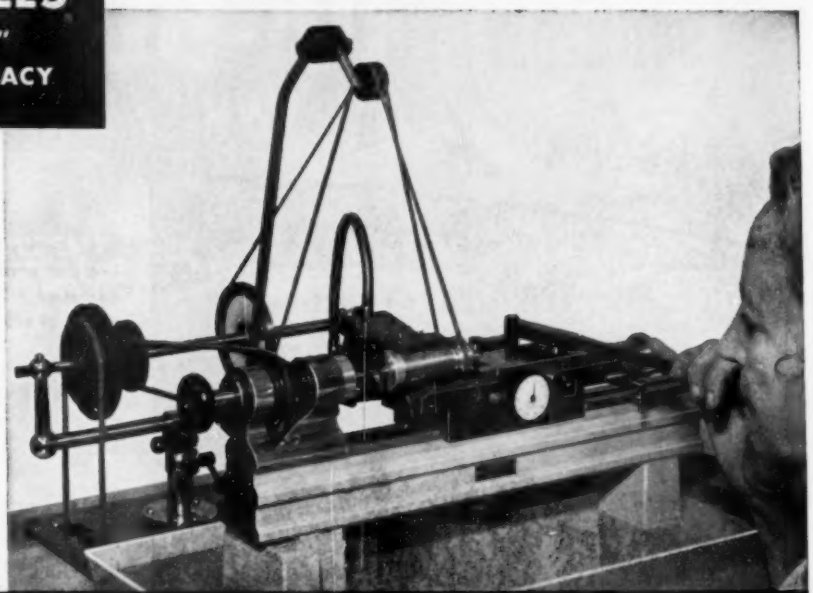
Company Name .....

Address .....

City..... State.....

DRILL MICRO-HOLES
DOWN TO .0016"
with SPEED & ACCURACY

ON LEVIN® INSTRUMENT LATHES



The Levin micro-drilling equipment shown here can be used with the smallest drills available. It is designed so that the drilling does not depend on the operator's sense of feel. The drill can be retracted for chip removal and returned to the drilling position without striking the bottom of the hole. While commercial drills can be had as small as .0016" this micro-drilling apparatus has successfully produced holes as small as .0006".

Send for Catalog M describing complete line of instrument lathes and accessories.

LOUIS LEVIN & SON, INC.—3610 S. BROADWAY—LOS ANGELES 7, CALIFORNIA

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-260-1

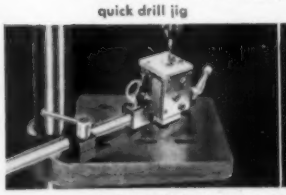
AMF Float-Lock Instant-Change Vise makes drill press COMPLETE MACHINE TOOL

Positive anchoring..."Floats" and "Locks" in any position. Thumb-operated release ring permits instant change of jaw opening. Bosses on 2" centers provided on ratchet jaw for jig plates. Two models...9" and 12" capacities. Special safety vise for band-saw also available. Send for complete literature now.

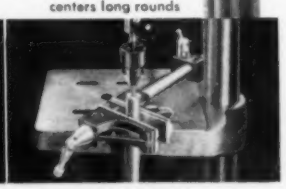
Another AMF Product
Float-LOCK SAFETY VISES

AMF TOOL DIVISION
AMERICAN MACHINE & FOUNDRY COMPANY
224-A Glenwood Avenue, Bloomfield, New Jersey

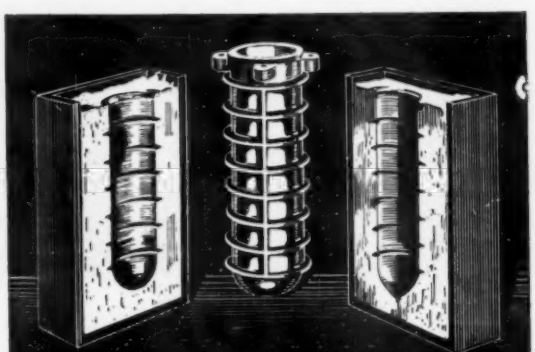
quick drill jig



centers long rounds



USE READER SERVICE CARD; INDICATE A-9-260-2



HOW TO CHUCK IRREGULAR PIECES

quickly and inexpensively

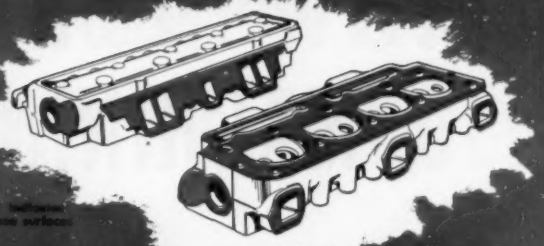
It's easy to make chuck jaws for irregular workpieces with Cerromatrix®, the low-temperature melting alloy. Just cast it against the workpiece and you get an accurately fitting pair of jaws. The alloy can be cast against forged metal parts, die castings, rubber, wood and most plastics without burning or warping the piece.

Send for Bulletin B5—it tells the whole story.

CERRO DE PASCO CORPORATION
300 Park Ave., Room 1503, New York 22, N. Y.

USE READER SERVICE CARD; INDICATE A-9-260-3

CUSTOMER SPECIFIED



A leading automobile company requested Kearney & Trecker's Special Machinery Division to design and build an automatic transfer machine to perform a series of milling and drilling operations on V-8 cylinder heads.

KEARNEY & TRECKER MILWAUKEE® DESIGNED

Kearney & Trecker built this 12-Station Automatic Transfer machine which rough and finish mills the head gasket surfaces, mills intake and exhaust port surfaces and both ends, and drills, counterdrills and reams two holes on each of two cylinder heads for V-8 engines. Machine's production rate is 100 pieces per hour.

The two cylinder heads progress automatically through the machine side by side, each on separate transfer rails. Transferring, locating, clamping, lubrication and chip disposal are all automatic.

For more information on machine illustrated, ask for Data Sheet No. 1080. A new bulletin, SMD-56, which describes many of our outstanding designs, is also yours for the asking.

Production efficiency starts with

Kearney & Trecker Milwaukee machine tools

This typical example reduced costs and meant higher production for the buyer. Kearney & Trecker's Special Machinery Division's 50 years' experience in machine design and manufacture can mean considerable savings to you.

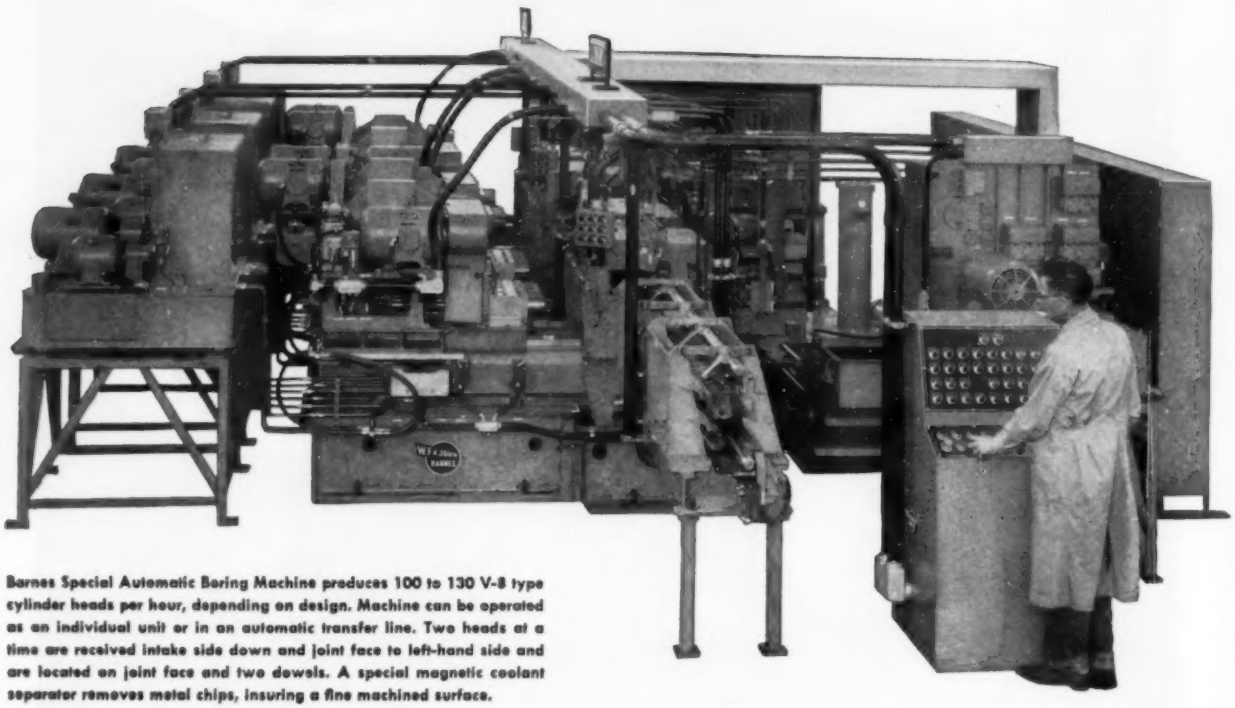
Take advantage of our abilities. They can pay off in profits for you. See or write your Kearney & Trecker Special Machinery Division representative. He will be pleased to give you all the details on this production machine. Contact him today!

Special Machinery Division

MILWAUKEE 14, WISCONSIN, U.S.A.

Designers and Builders of Precision and Production Machine Tools Since 1898

Now Available—NEW MACHINING AUTOMOTIVE



Barnes Special Automatic Boring Machine produces 100 to 130 V-8 type cylinder heads per hour, depending on design. Machine can be operated as an individual unit or in an automatic transfer line. Two heads at a time are received intake side down and joint face to left-hand side and are located on joint face and two dowels. A special magnetic coolant separator removes metal chips, insuring a fine machined surface.

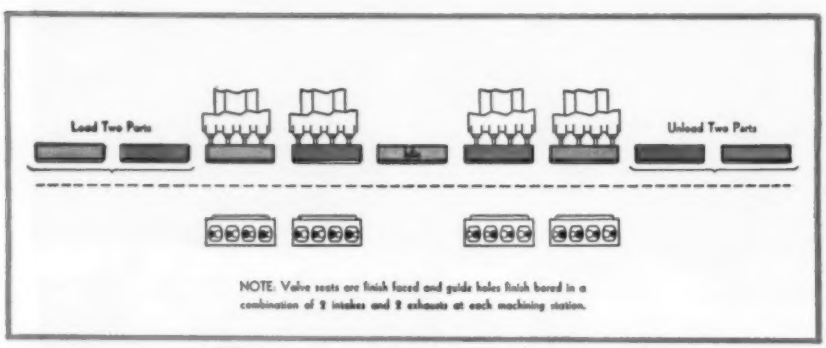
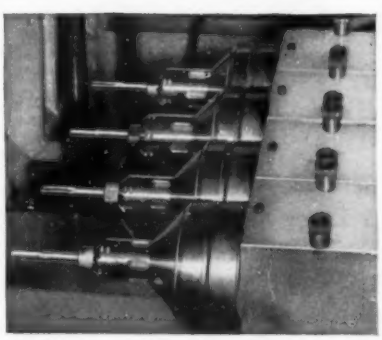

Load Two Parts
Unload Two Parts
NOTE: Valve seats are finish faced and guide holes finish bored in a combination of 2 intakes and 2 exhausts at each machining station.

Diagram above illustrates how heads are transferred two at a time and machining operations arranged to meet high output requirements. For lower production, machines are designed with fewer machining stations and one-station transfer unit.



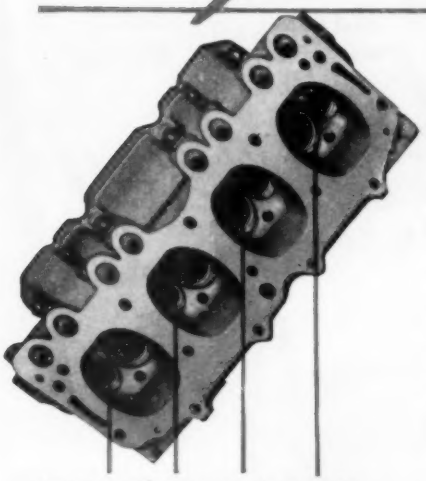
Closeup of 4-spindle head with special tools for machining four valve seats and stem holes in one pass. Second 4-spindle head completes remaining operations.

W. F. & JOHN BARNES

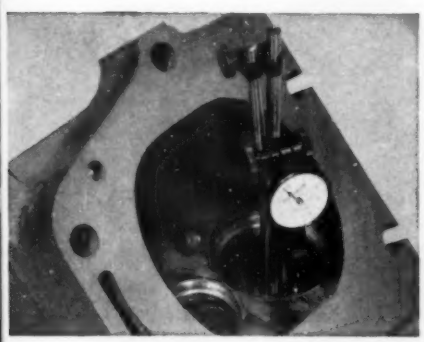
Builders of Better Machines Since 1872

MULTIPLE SPINDLE DRILLING • BORING • TAPPING

PRECISION METHOD OF FINISH VALVE SEATS AND STEM HOLES *Automatically*



Cylinder head for V-8 engine showing finish machined valve seats and guide holes. Red arrows indicate operations performed at first machining station.



Concentricity of valve seat and stem hole held to .0005" total indicator reading.

EXCLUSIVE W. F. & JOHN BARNES MACHINING DEVELOPMENT HOLDS TOTAL CONCENTRICITY WITHIN .0005"

Now, a new precision machining method developed exclusively by W. F. & John Barnes makes it possible for you to finish machine automotive valve seats and stem holes on a continuous automatic basis. You can now eliminate corrective operations after normal boring, reaming, and seating operations, because this new development holds total concentricity within .0005" (total indicator reading). This new machining process, as incorporated into Barnes Automatic Progress-Thru Type Machines, consists of multi-blade tooling for the valve seating operations, combined with modified gun drilling tools for precision boring valve guide holes. Production tests show the valve seat tools produce 10,000 to 15,000 parts, and the boring tools, between 2,500 and 4,000, before regrinding or replacement is necessary. The net result has increased production efficiency and improved product quality at lower cost. Write for more facts today.

TO SAVE TIME INVESTIGATE BARNES' 6-POINT MACHINE TOOL BUILDING SERVICE

For over 75 years, Barnes has designed and built special machinery. These years of experience can assist you in saving time and cutting costs. Check the advantages of an engineering and building service from one convenient source.

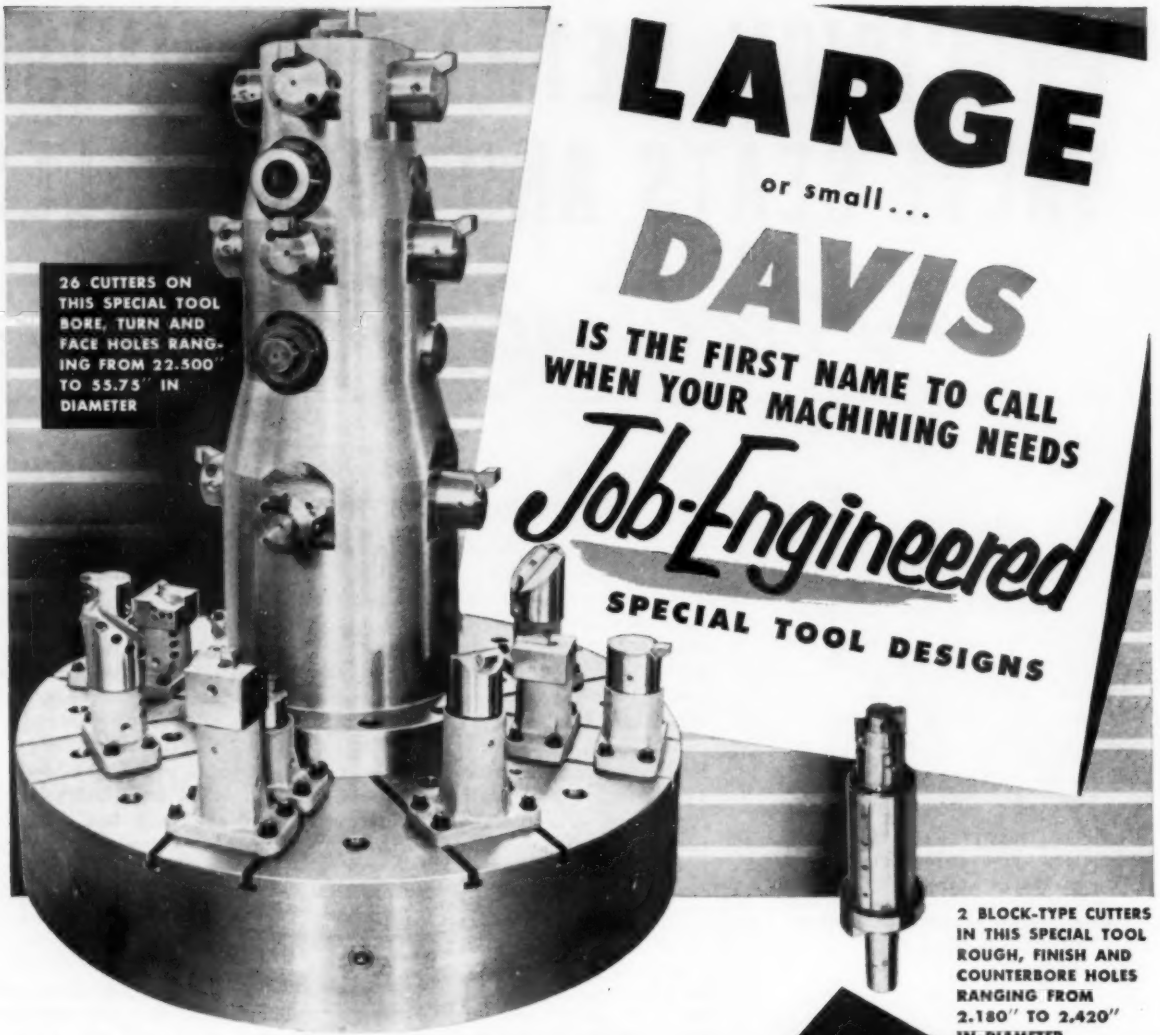
1. **SPECIALIZED MANUFACTURING FACILITIES**—75-year background, large well equipped plant efficiently tooled to build high production machines.
2. **SPECIAL HYDRAULIC EQUIPMENT**—designed and built to meet JIC standards. Individually engineered units assure smooth, dependable actuation for every requirement.
3. **SPECIAL ELECTRICAL EQUIPMENT and CONTROLS** — individually designed and built for maximum safety and ease of control, with circuits that assure the most dependable coordination of all machine functions.
4. **SPECIAL GAUGES, FIXTURES, TOOLS**—designed for each individual machining problem, assure accuracy of operations at high production speeds.
5. **SPECIAL HANDLING AND CONVEYOR EQUIPMENT**—designed and built to reduce work handling, effect maximum safety and efficiency.
6. **COORDINATED DESIGN AND ENGINEERING**—Mechanical, Hydraulic, Electrical, Process, Tool, and Fixture Engineers work together at Barnes. Team-work solves complex problems quickly.

WRITE FOR FREE BOOKLET

Ask for free booklet "Coordinated Machine Engineering" describing the scope of Barnes machine tool building service.

W. F. & JOHN BARNES COMPANY
405 SOUTH WATER STREET, ROCKFORD, ILLINOIS

MACHINES • AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES



26 CUTTERS ON THIS SPECIAL TOOL BORE, TURN AND FACE HOLES RANGING FROM 22.500" TO 55.75" IN DIAMETER

LARGE

or small...

DAVIS

IS THE FIRST NAME TO CALL WHEN YOUR MACHINING NEEDS

Job-Engineered

SPECIAL TOOL DESIGNS

2 BLOCK-TYPE CUTTERS IN THIS SPECIAL TOOL ROUGH, FINISH AND COUNTERBORE HOLES RANGING FROM 2.180" TO 2.420" IN DIAMETER

Yes, large or small, simple or complex, you always tool jobs better with Davis. One reason is the big, extra bonus of machining know-how that goes into every Davis tool.

In the design of special tools, like those above, Davis' broad experience and unsurpassed engineering skill assure recommendations complete in every detail of speeds, feeds, fixtures and maximum combination of multiple operations into single tools for increased production at lowest cost.

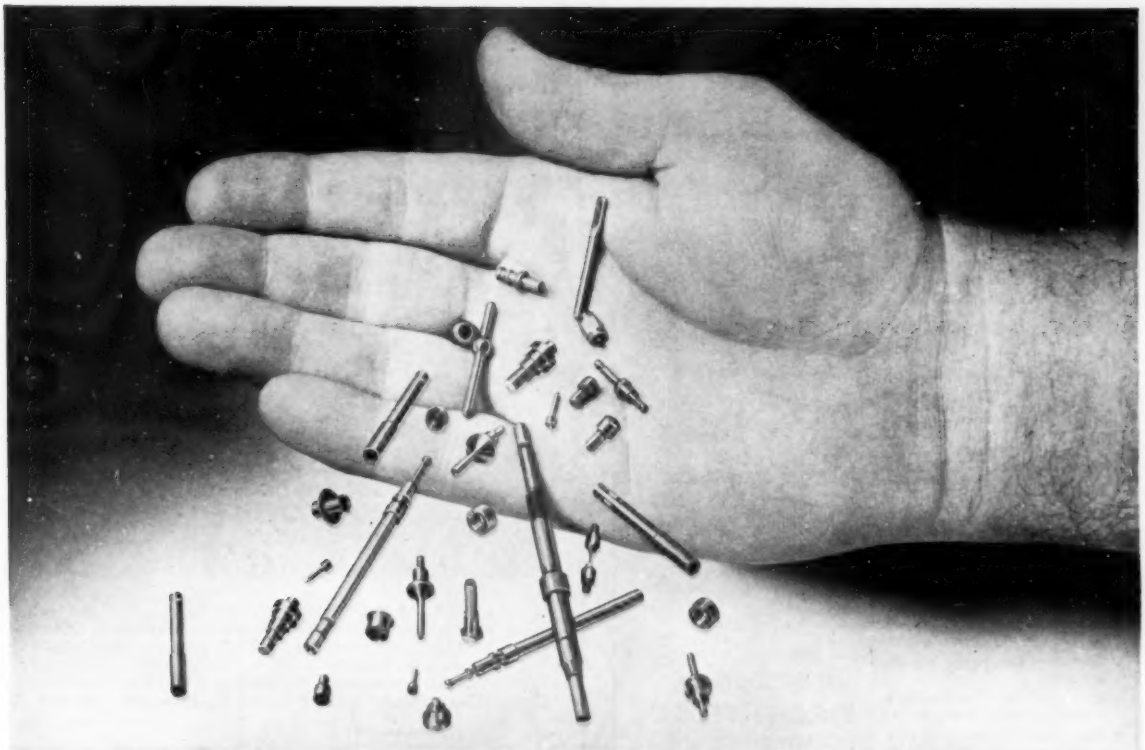
DAVIS ALSO OFFERS INDUSTRY'S MOST COMPLETE STANDARD TOOL LINE

In standard blocks, boring heads, bars, and tool sets, the Davis line features thousands of items to assure unrestricted selection in tooling up virtually any routine job.

Your local Davis Field Engineer is as close as your telephone, and behind him are the complete facilities of Davis' application engineering department, ready to serve you with special or standard tools.

DAVIS BORING TOOL DIVISION of
Giddings & Lewis Machine Tool Company
Fond du Lac, Wisconsin

THE ONE NAME THAT CERTIFIES ULTIMATE PRECISION AND PRODUCTIVITY IN TOOLING



Do small parts like these give you large problems?

Anaconda Rod solved costly production problems for G & F Manufacturing Company, Philadelphia

The trend toward miniatures has led to a tremendous increase in the use of small precision parts like these. And this has placed a heavier burden on the screw machine operator and the buyer of rod. Uniformity of alloy and dimension in batch after batch of screw machine rod is vital for economical production.

ONE COMPANY'S PROBLEM: The G & F Manufacturing Company of Philadelphia specializes in automatic screw machine production of minute parts, finished to precise dimensions. This company was experiencing costly production delays with the rod they were using, due to jamming and freezing of the rod as it was fed into the machines.

THE SOLUTION: Then G & F tried Anaconda Free Cutting Brass-271 Rod in the diameters required for their type of small-part production. They found it highly satisfactory. Down time, due to jamming or freezing of the rods, has been practically eliminated and production schedules are completed without costly interruption.

Whether for small parts of extreme accuracy—or for ordinary screw machine production—The American Brass Company can furnish free-cutting copper and copper-alloy rods fabricated to meet the requirements of the operation—uniform in length, diameter, temper and composition.

FREE TECHNICAL SERVICE: It is the function of the Technical Department of The American Brass Company to assist metal users in the solution of special problems. This service is at your disposal without charge or obligation.

Comprehensive data on composition and machinability of standard Anaconda Alloys, standard specifications, weights and dimensions of standard rods is available in Publication B-3. For this booklet—for special technical assistance—write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA® RODS FOR SCREW MACHINE PRODUCTS

Speed Versatility and Economy

Tooling costs go down when Speed Vise goes on the job because Speed Vise eliminates the need for expensive jigs and fixtures. Just a simple jaw plate to fit the part being drilled and Speed Vise does the rest. Several interchangeable Speed Vise jigs and fixtures can be made for the cost of one old style box type jig. The operation of Speed Vise tooling is **many times faster** than the operation of such conventional jigs and fixtures. Speed Vise tooling is economical to build, efficient to use, compact to store.

-SPEED VISE-
GIVES YOU 100 JIGS IN ONE

$10.90 to $22.90

- ★ Quick action design for speed. Opens instantly to full capacity to handle work of any size.
- ★ Standardized holes for attaching jigs or jaw plates.
- ★ Lift...slide...lock...that's all there is to the fast, positive locking action.
- ★ Heavy, semi-steel castings for extra strength and a heavy base plate for rigidity.

Write or wire now for information

CARDINAL MACHINE CO.
1819 Dana Street
Glendale, California

USE READER SERVICE CARD; INDICATE A-9-266-1

Air-Cooled Lighting by Dazor at Low Cost

Choice of Arm Extensions:
31" (No. 1100)
20" (No. 1101)
Same Price

Adjustable-Arm Models

Light up machines and benches at rock-bottom cost and get Dazor dependability besides. New Adjustable-Arm Lamps mount solidly, hold fast in any position set. Either top- or side-mounted reflector. Air-cooled housing is safe to handle despite continuous use. Gray baked enamel over bonderizing. Call your Dazor distributor. Dazor Manufacturing Corp., St. Louis 10, Missouri.

...Makers of

DAZOR FLOATING LAMPS

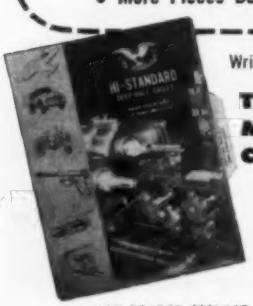
USE READER SERVICE CARD; INDICATE A-9-266-3

DRILLING COSTS TOO HIGH?

In Steel . . . Stainless . . . Brass . . .
Aluminum . . . Titanium . . . and Wood

HI-STANDARD Deep-Hole Drills give you . . . at lower cost . . .

- Exacting Hole Diameters
- Unlimited Hole Depth
- Exceptional Hole Concentricity Throughout
- Improved Hole Surface Finish
- More Pieces Between Grinds



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THE HIGH STANDARD MANUFACTURING CORPORATION
Hamden, Connecticut

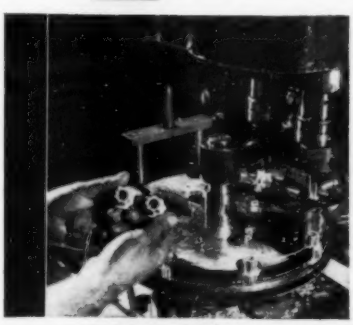
Pioneers and Makers of Deep-Hole Drills For More Than 30 Years ★

USE READER SERVICE CARD; INDICATE A-9-266-2

TAPPING . . . 2,040 Aluminum Pistons PER HOUR

½" . . thread—¾" stroke at 500 RPM

That's *actual production tapping*, as accomplished with a Kaufman Model 5-24 lead screw tapping machine, tooled with a 4 division index, dial and dial spindle multiple head. "Setting Up" for other tapping operations is accomplished by replacing dial plate and taps.



TOOLING FOR TOMORROW

As you plan production machines for the future . . . study the highly-precisioned machines available from Kaufman. Machines specifically designed for high-production runs, or for the versatile, multiple, Machine Shop requirements.

Send prints and samples of your work to . . .

KAUFMAN MFG. CO.
553 S. 29th ST., MANITOWOC, WIS.

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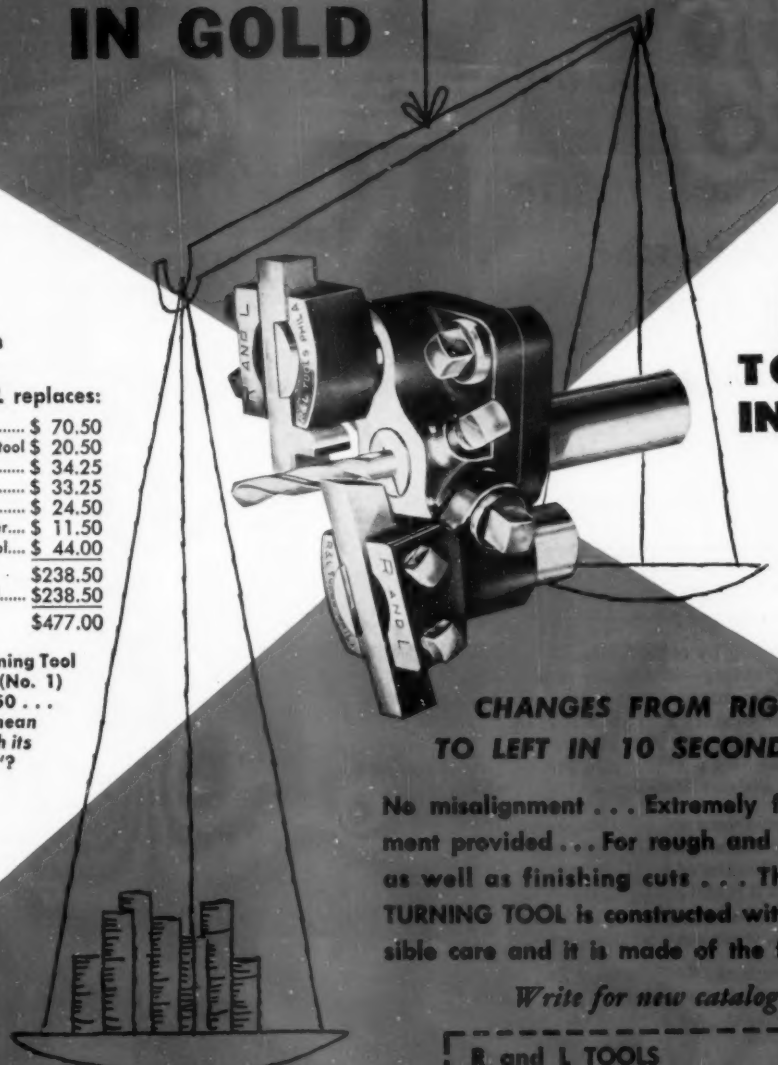
WORTH ITS WEIGHT IN GOLD

R and L TURNING TOOL



14 TOOLS IN ONE

Here are the tools which the R and L TURNING TOOL replaces:

Roller Box Tool	$ 70.50
Centering & facing tool	$ 20.50
Knee Tool	$ 34.25
Pointing Tool	$ 33.25
Back Rest	$ 24.50
Floating Drill Holder	$ 11.50
Balance Turning Tool	$ 44.00
	$238.50
Same for left hand	$238.50
	$477.00

One R and L Turning Tool of similar size (No. 1) costs only $87.50 . . . *See what we mean by being "Worth its weight in gold"?*

CHANGES FROM RIGHT TO LEFT IN 10 SECONDS

No misalignment . . . Extremely fine adjustment provided . . . For rough and heavy cuts as well as finishing cuts . . . The R and L TURNING TOOL is constructed with best possible care and it is made of the finest steel!

Write for new catalog

R and L TOOLS
1825 Bristol Street, Philadelphia 40, Pa.

☐ Send new catalog
☐ Please arrange for no-obligation demonstration of R and L TOOLS

NAME .....

COMPANY .....

ADDRESS .....

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TE-9

RIGHT R and L LEFT TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

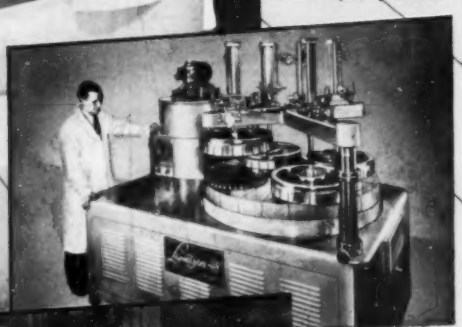
TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS • RELEASING DIE HOLDER FOR ACORN DIES • UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

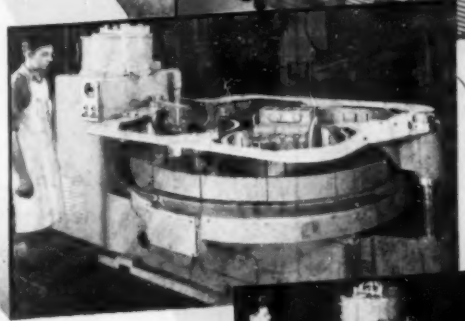
in this line-up . . .

Model 12 handles 3
4-in. dia. parts up to 705
¼-in. dia. parts per load.

Model 24 handles 3
9½-in. dia. parts up to 3900
¼-in. dia. parts per load.

Model 36 handles 4
13¾-in. dia. parts up to 4000
⅜-in. dia. parts per load.

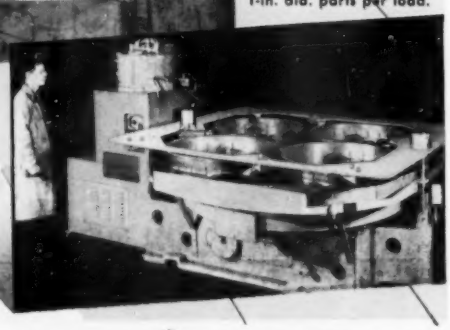




Model 48 handles 4
17-in. dia. parts up to 940
1-in. dia. parts per load.

Model 72 handles 4
27-in. dia. parts up to 2480
1-in. dia. parts per load.

Model 84 handles 4
32-in. dia. parts up to 3500
1-in. dia. parts per load.



there's a specific *Lapmaster*® to give you:

1 Precision Flatness

2 Precision Finish

in production quantities

Parts large or small—tall or squat—whatever the case may be, there's a Lapmaster tailor-made to meet your production requirements at the lowest possible cost per piece.

If you are now lapping by other means—hand scraping or grinding—it will pay you to investigate the Lapmaster. Our fully equipped lapping laboratory is at your disposal to analyze your problem, test run a number of pieces and furnish you with a complete production report without obligation.

"John Crane" Lapmasters are capable of consistently producing flatness to less than one light band (11.6 millionths of an inch), microinch finishes of 2 to 3 RMS on all materials including cast iron, steel, magnesium, aluminum, brass, carbon, ceramics and plastics.

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Free data

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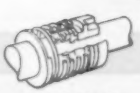

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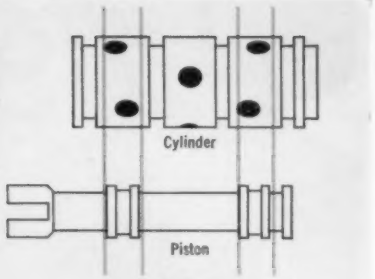
TEFLON PRODUCTS

LAPPING MACHINES

THREAD COMPOUNDS

CRANE PACKING COMPANY

MATCH PISTON LANDS TO CYLINDER PORTS PRECISELY WITH SHEFFIELD'S MICRO-FORM GRINDER



This servo cylinder and piston are typical of the very precisely machined hydraulic components in aircraft propeller and flight control systems.

With the actual cylinder as a reference, each piston land is individually ground to match the inside edge of its respective cylinder port.

If a flow test then reveals the slightest discrepancy between land and port edge, the piston is given a finishing touch, using a Sheffield Precisionaire and Airetest Indicator to show progress in stock removal. Thus, the correction of the land face can be accomplished to within ± .000010".

This is typical of the wide range of Micro-Form Grinder applications in duplicating precision profiles or reverse profiles from a master. Write for Bulletin MFG-121-C to Dept. 19,

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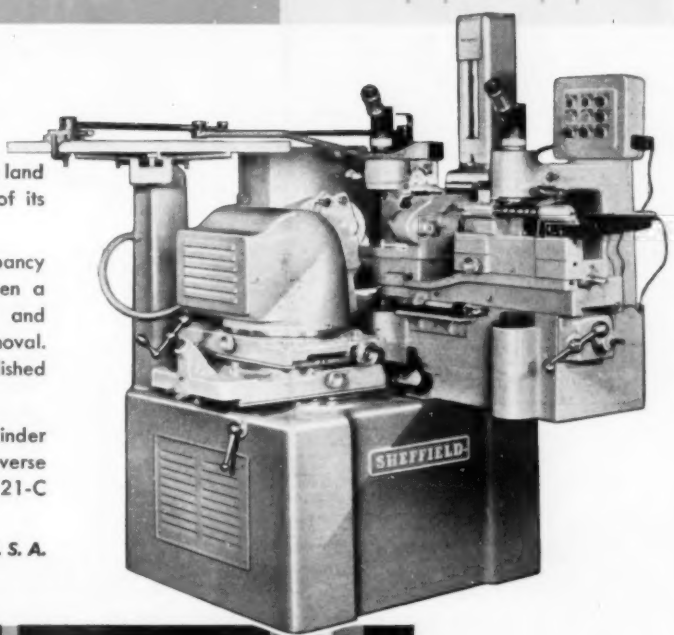
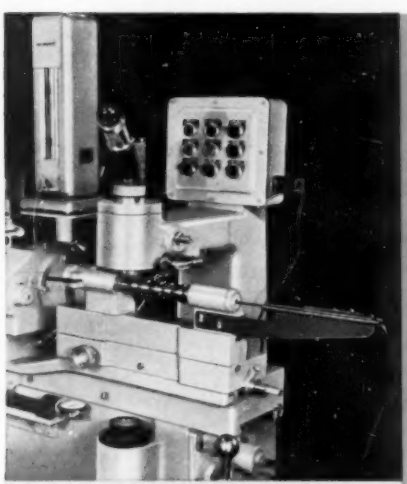
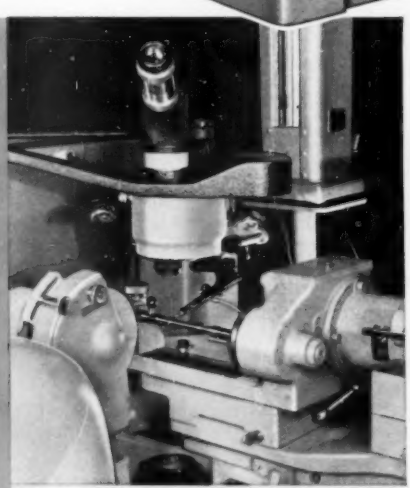




Cylinder under observation on auxiliary table.



Airetest Indicator shows stock removal in final correction.

7560

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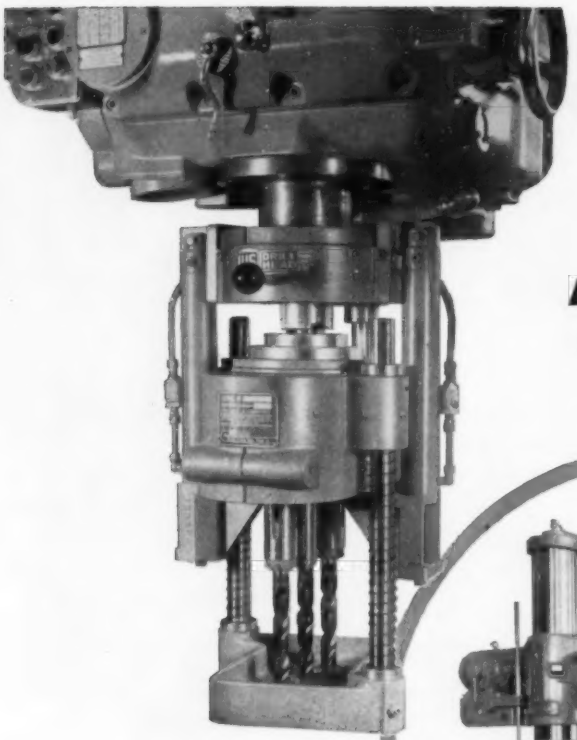
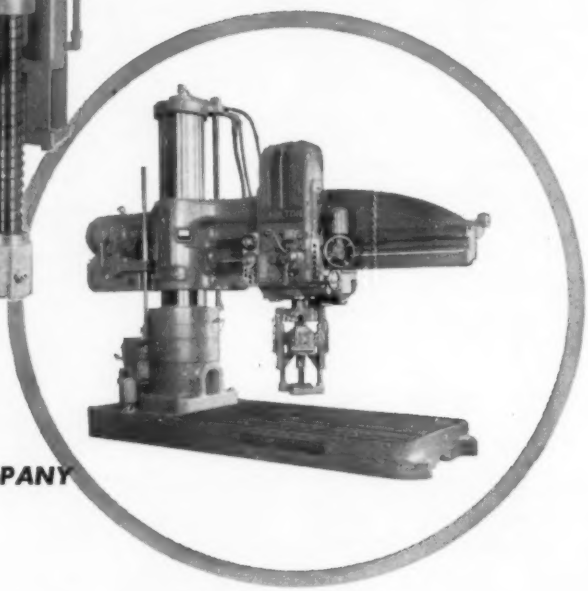


new

AIR COUNTERBALANCE SWIVEL ATTACHMENT

FOR RADIAL DRILLING MACHINES



THIS IS ANOTHER FIRST FOR THE U. S. DRILL HEAD COMPANY

This new combination Swivel and Air Counterbalance attachment makes it possible to adapt large multiple spindle drill and tapping heads to radial drilling machines.

Flexible and easily adjusted, it insures maximum safety for the operator, as well as better operating economy.

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This package is ideally suited for drilling condenser plates, boiler tube sheets, flue sheets, etc.

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THE UNITED STATES DRILL HEAD COMPANY

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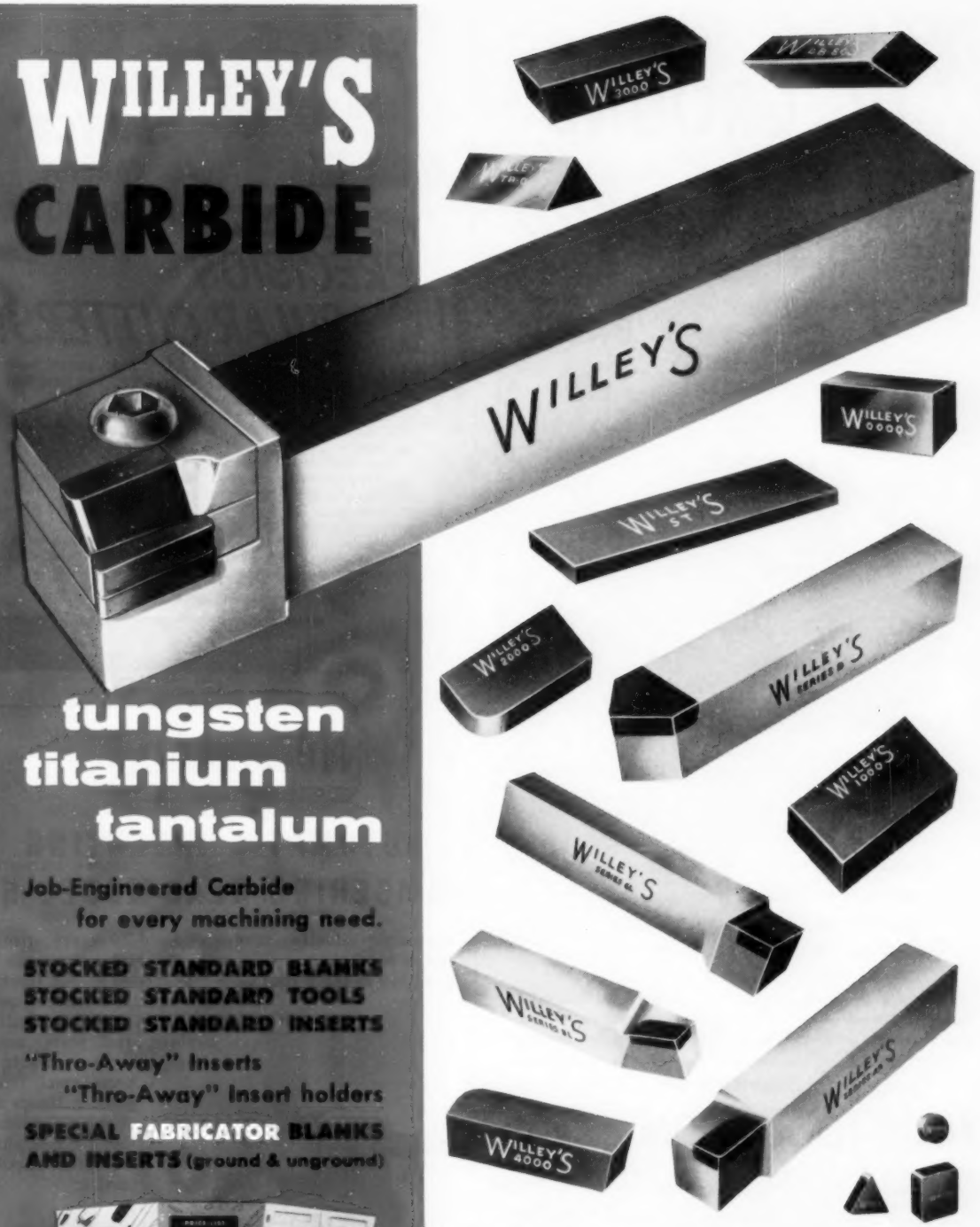

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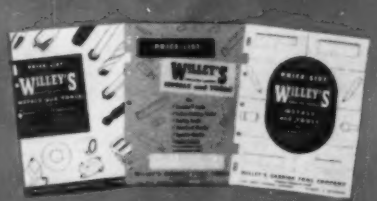

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Cuts threading costs to $0.00003 per piece

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FROM THESE "CAST-TO-SHAPE" SWAGING DIES

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ADDRESS DEPT. TE-81

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No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

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FOR
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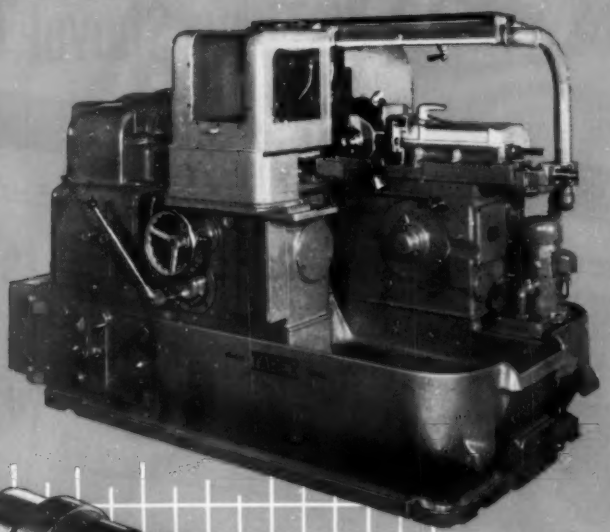

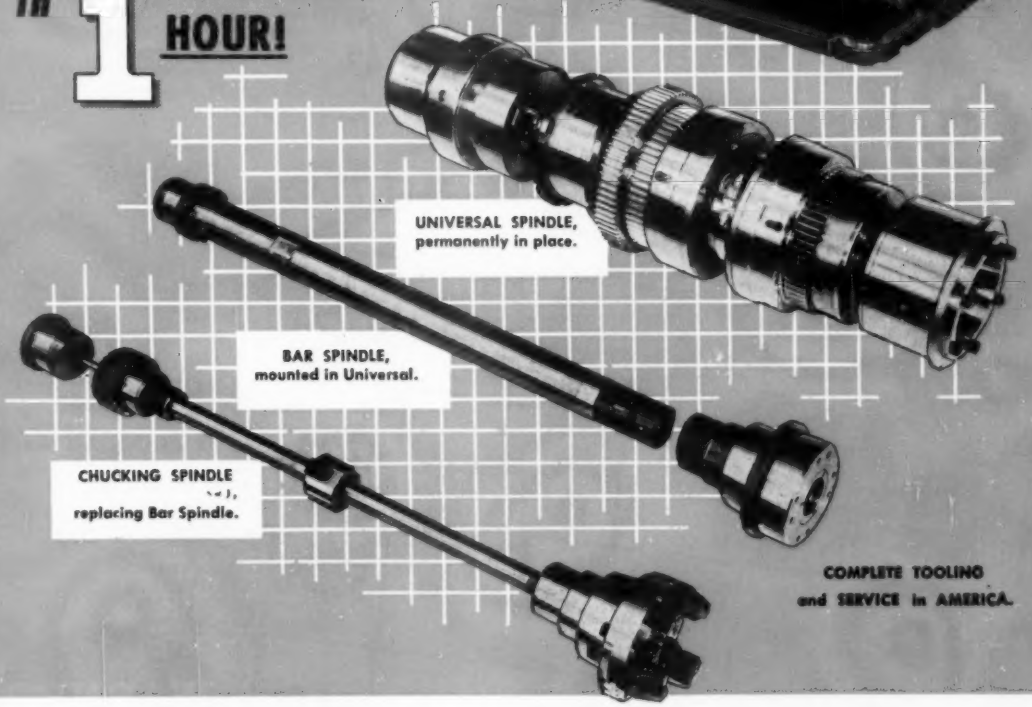

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pay for themselves with one year's savings at Thew Shovel Company

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	Roller	.392 hours	.087 hours	2000	77.8%
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	Roller	.373 hours	.126 hours	447	66.2%
	Roller	.372 hours	.141 hours	109	62.2%
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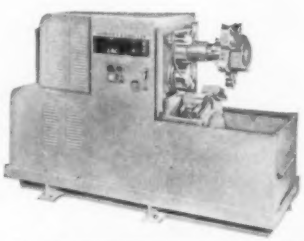
	Box	.431 hours	.193 hours	108	55.6%
	Box	.504 hours	.231 hours	36	54.0%

Cost savings from 47% to 77%! That's the production record of two Warner & Swasey 2AC Automatics on small and medium lot work at Thew Shovel Company, Lorain, Ohio. Annual dollar savings exceed the cost of both machines plus tooling! On small and medium lot work these automatics can undoubtedly return substantial savings for you. To discuss their application to your work, call in our Field Engineer.



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8" or 10" Chuck—6" Working Stroke

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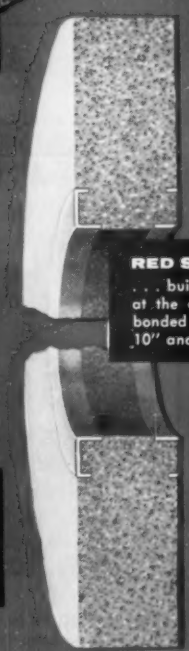

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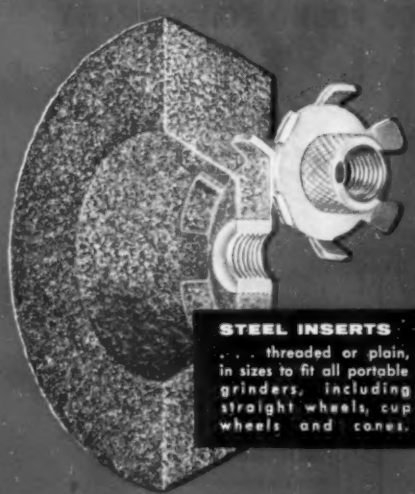

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. . . threaded or plain, in sizes to fit all portable grinders, including straight wheels, cup wheels and cones.

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. . . a hard, non-metallic material with a smooth surface, replaces lead or plain holes, principally for precision grinding wheels.

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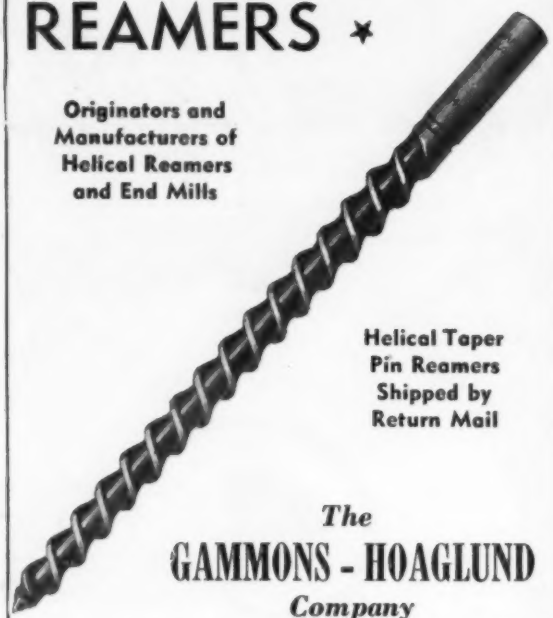

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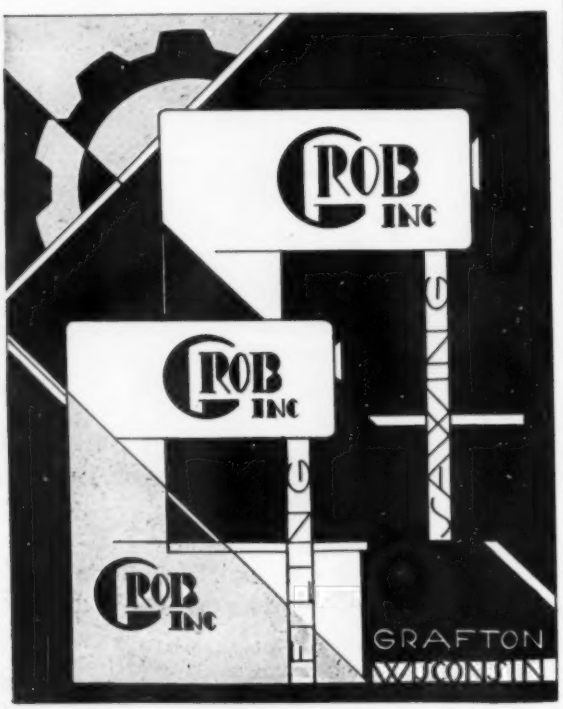

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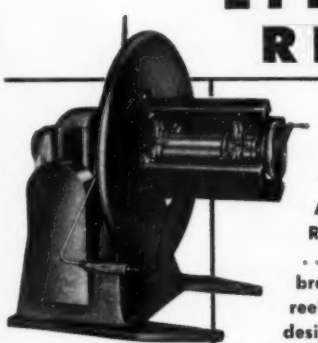
LITTELL REELS



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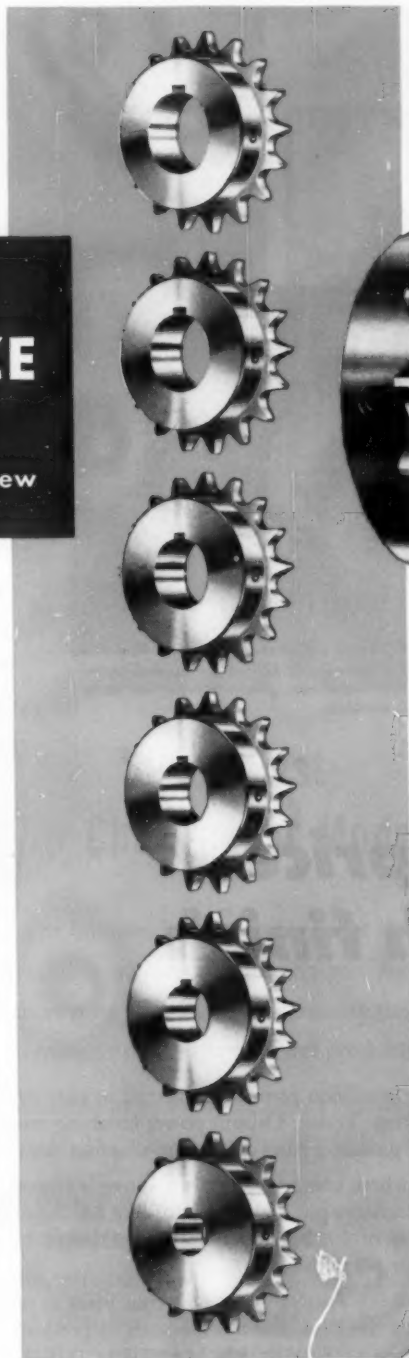

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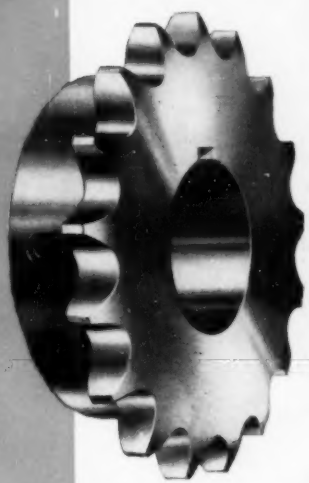


"OFF-THE-SHELF" — AT FACTORY PRICES

FINISH BORED – READY TO INSTALL Single width steel sprockets ⅜″ Pitch through 1″ Pitch—in 76 commonly used Tooth Sizes —with a full selection of finished bore diameters for each sprocket—complete with keyway and setscrew.

ELIMINATE BORING EXPENSE You save expense of reboring, keyway cutting, drilling and tapping for setscrew—and avoid downtime in emergency replacements.

BOSTON GEAR QUALITY Sets the standard for precision and performance—assures longer service life for both sprockets and chain.

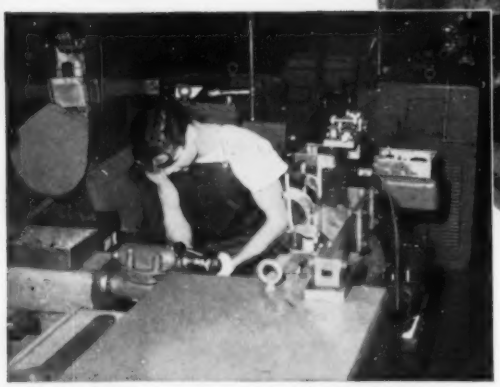
OFF-THE-SHELF DELIVERY More than 100 BOSTON Gear Distributors can supply BORED-TO-SIZE Sprockets from stock. Get complete information, on any question of sprocket selection or application, from factory-trained specialists . . . at the Distributor near you. Boston Gear Works, 83 Hayward St., Quincy 71, Mass.

The BOSTON Gear complete line provides any Sprockets you need including SHOLD-A-GRIP interchangeable tapered Sprockets and Bushings. For complete listings, see BOSTON Gear Catalog No. 56.

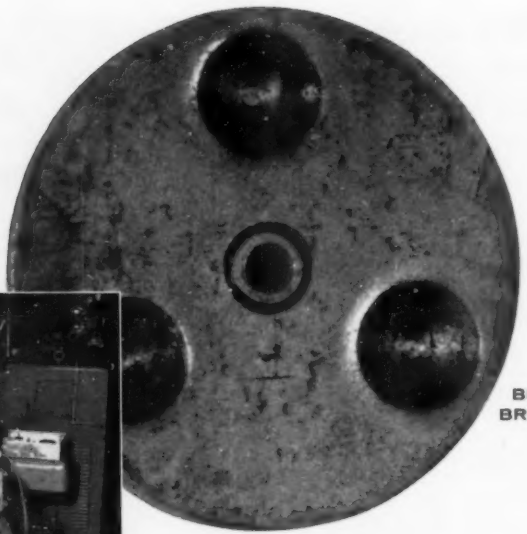
CALL YOUR **BOSTON® Gear** DISTRIBUTOR

For nearest Distributor, look under "GEARS" in the Yellow Pages of your Telephone Book.

56BG-S-23



A manufacturer of computers and business machines improves the quality of precision components, greatly reduces costs using Osborn Brushamatic machines.



BEFORE BRUSHING

AFTER BRUSHING

Low price on high finish

A few years ago, precision parts were finished in custom lots at considerable cost. Today, Osborn power brushing methods put finer finishes on precision parts at mass-production rates.

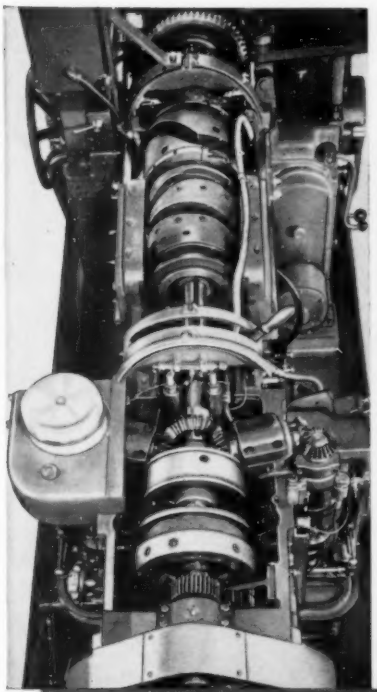
The business machine component shown above is typical. Brushamatic® Machines put a high, mirror-like finish on all flat and depressed surfaces of this ball retainer in just 25 seconds—*finish 6 parts for the former cost of finishing 1.*

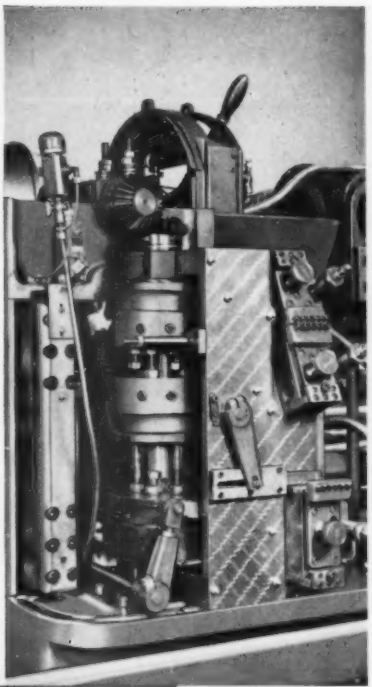
An **O**sborn **B**rushing **A**nalysis, made in your plant at no obligation, will show how *you* can use Brushamatic® methods to produce finer finishes at lower cost. Write THE OSBORN MANUFACTURING COMPANY, DEPT. K-27, 5401 HAMILTON AVENUE, CLEVELAND 14, OHIO.

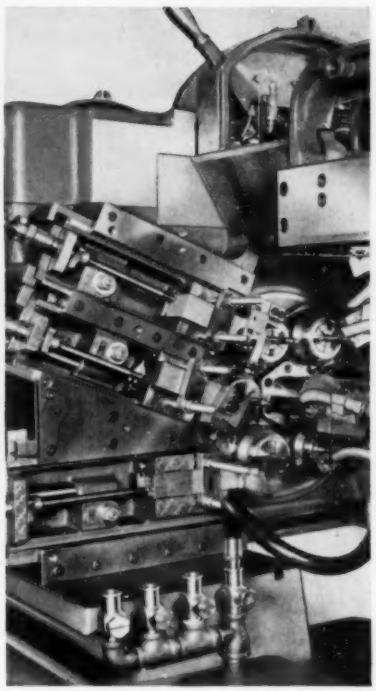
Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES





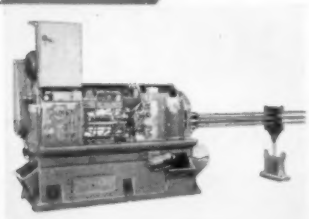


Seven Fast Changeover Models

With the prospects of improved tool materials ever decreasing the actual machining time of work on Multiple Spindle Automatics, long runs tend to become short runs. Facility that decreases the time for job changes becomes more important to low-cost production.

Conomatics are available in as many as seven fast changeover models. These are the 9/16", 1", 1 5/8" Sixes, and the 2 5/8", 3 1/2", 5", and 5 1/4" Fours.

These models are equipped with dial adjustment of working stroke of all slides, without making necessary change of total stroke or positive stop settings. Write, wire, or phone for literature descriptive of these features and other facilities available to users, or prospective users.

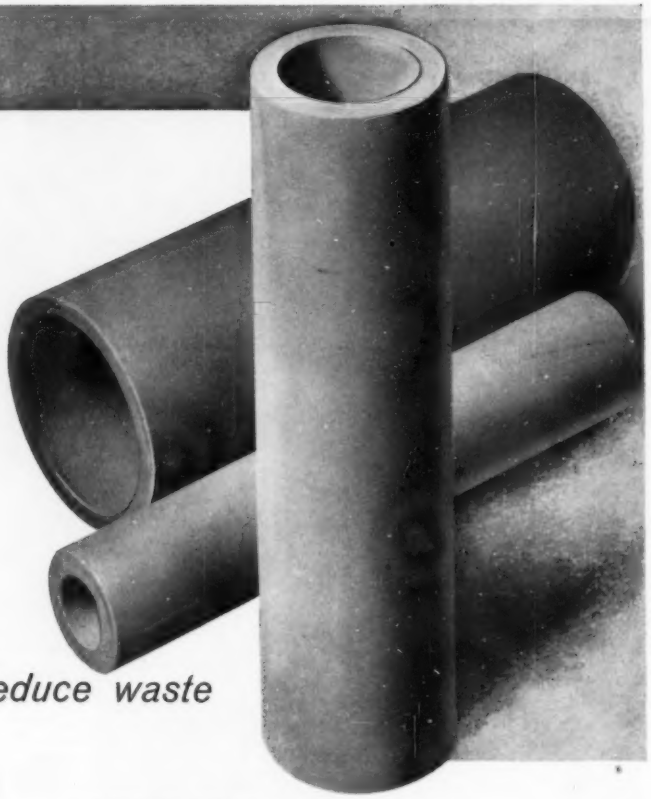


Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

Now semi-finish machined all over

to save your machining time and reduce waste



AMPCO METAL GRADE 18 CENTRIFUGALLY CAST STOCK BARS

Ampco Grade 18 Stock Bars are now labeled on one end, for convenience in stocking. Labels show I.D. and O.D. sizes to which bars finish.

14 New Sizes! Sizes now range from 1¼" to 8" I.D., 1¾" to 10" O.D. 12½" lengths.

Purchasing Simplified! Stated sizes are now the sizes to which bars will finish.

New Convenience! Finish allowance, 1/16" on the diameter, both O.D. and I.D. You need make only finish-machine cuts.

Same Dependability! Ampco Metal Grade 18 is a unique aluminum-bronze alloy that resists wear, withstands shock and impact, lasts many times longer than ordinary bronzes. Ideal for bearings, bushings, gears, other parts.

Stock the sizes you ordinarily use in maintenance and tooling — and get other sizes promptly from your nearby Ampco stocking distributor.

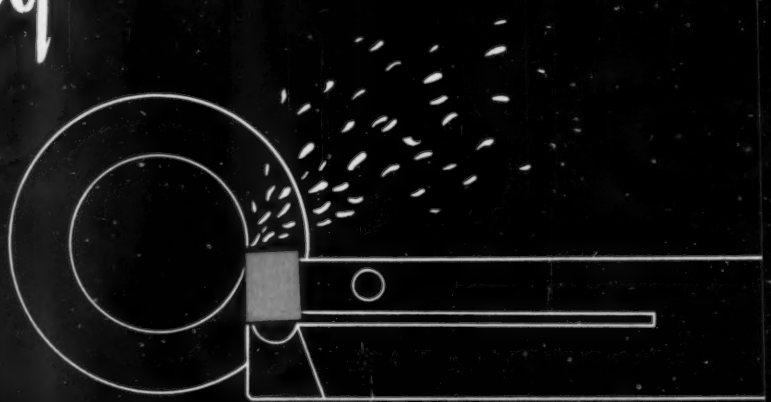
Write today for new stock list.

AMPCO METAL, INC.

Dept. TE-9
Milwaukee 46, Wis.
West Coast Plant
Burbank, California

D-58

Tomorrow's Cutting Tools...



Today!... SINTOX®

Sintox is Today's ceramic—It's time saving—it's cost saving. For use on Today's machine tools—on Today's materials. Specify Sintox on Today's Jobs.

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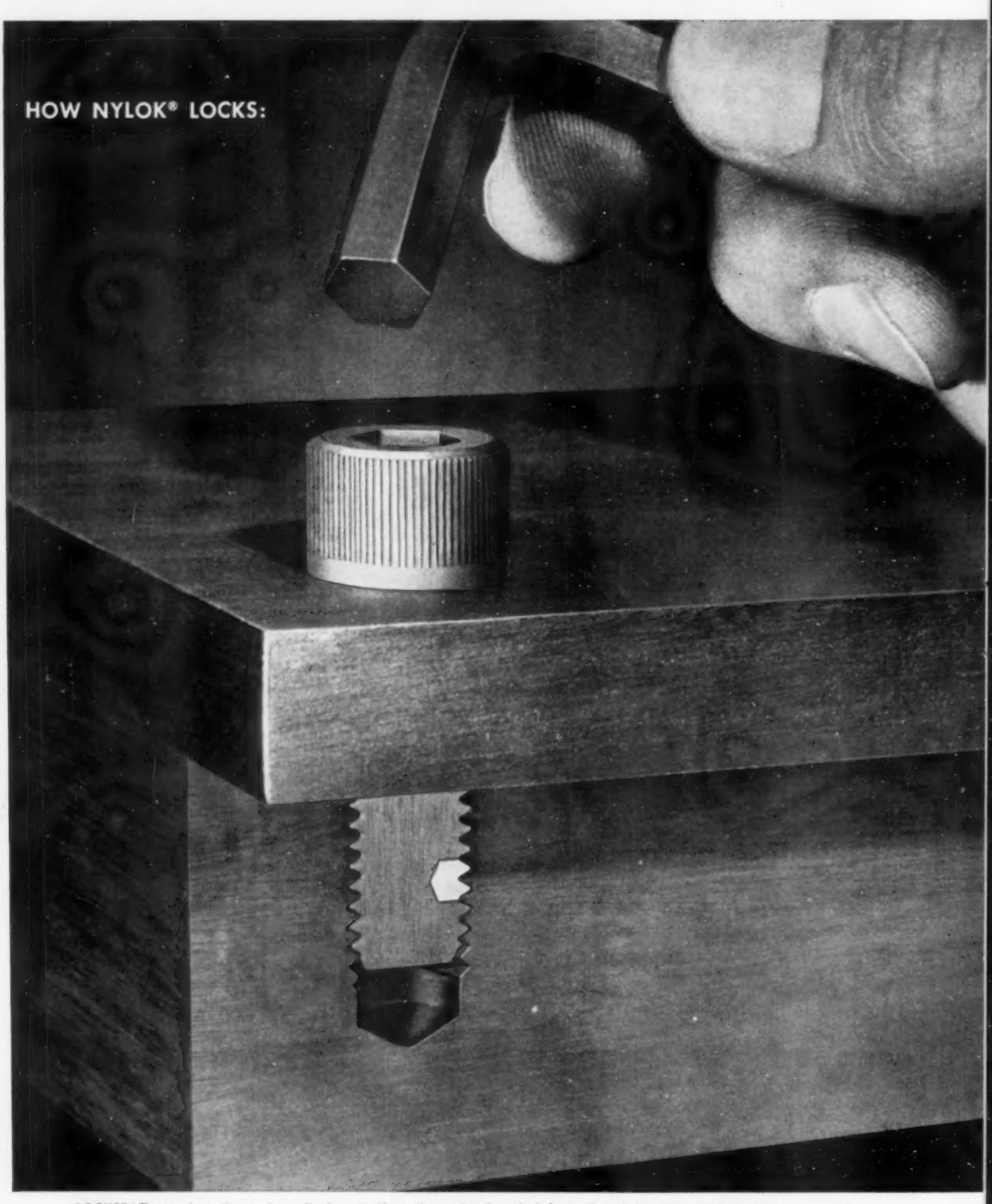
270 EAST HAMILTON STREET • ALLENTOWN, PENNSYLVANIA

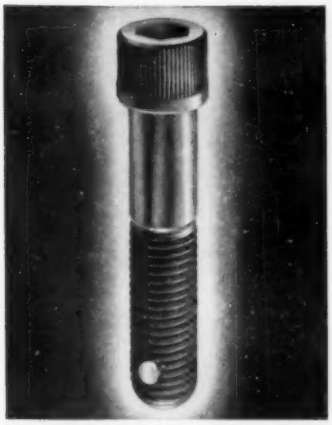
See us at the Metal Show **BOOTH 1823**

NEW—self-locking UNBRAKO

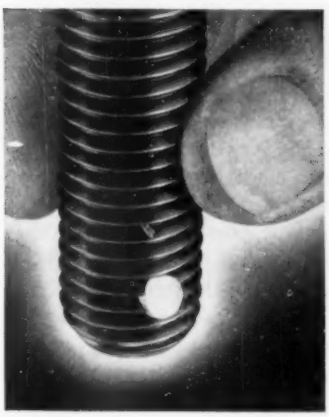


LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together and locks the screw securely.

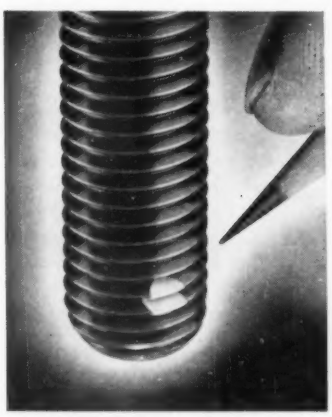
socket head cap screws



Self-locking UNBRAKO socket head cap screw.



BEFORE ASSEMBLY. The nylon pellet projects slightly. When assembled, threads will be impressed into it.



AFTER REMOVAL. "Plastic memory" of pellet has expanded impressed threads to greater diameter than screw threads. Screw can be used repeatedly. In use, "memory" keeps threads tightly locked.

They won't work loose. And they simplify design and save production time.

UNBRAKO socket head cap screws are now available embodying the Nylok* self-locking principle. Nylok provides the first truly practical solution to the problem of making cap screws self-locking.

An UNBRAKO cap screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the UNBRAKO into any tapped hole. *Seated or not*, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not work loose.

You save production time when you make products with self-locking UNBRAKOS. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. And in many cases you will save weight and mass by using shorter screws in tapped holes instead of drilling through and using nuts and lockwashers.

Self-locking UNBRAKOS are reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, when screws are properly seated, the locking pellet also functions as a liquid seal.

A complete line of self-locking UNBRAKO socket screw products, in a wide range of standard sizes, materials and finishes, is available through your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

**T.M. Reg. U.S. Pat. Off., The Nylok Corporation*

UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN ■ PENNSYLVANIA

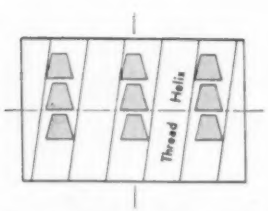
BARBER-COLMAN offers

thread milling requires accurate cutter design!

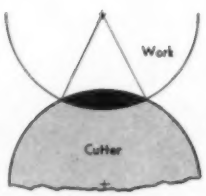
mathematical computation of cutter form

Multiple thread milling cutters often produce a thread space form which is not a duplicate of the cutter tooth form. The cutter tooth form is not a duplicate because the cutter tooth rotates in a plane which is perpendicular to the work axis and at an angle to the thread helix. This generating action produces a fillet at the bottom of the threads, and a thread space which is wider than the cutter tooth. When the amount of generating produces an unsatisfactory thread form, the cutter must be developed to produce the desired thread tooth thickness without fillet interference.

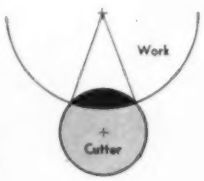
Whenever required, Barber-Colman engineers, by mathematical computation, design the correct cutter which compensates for the generating action. In this computation, the diameter of the cutter is very important since the amount of tooth form correction increases as the diameter of the cutter increases. A thread produced by a specially-developed cutter will have an accurate form which will fit the gage with the desired bearing.



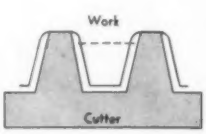
This schematic drawing shows how a multiple thread milling cutter produces a thread space which is wider than the cutter tooth. The cutter is set so that the plane of rotation of the cutter teeth is perpendicular to the work axis, and at an angle to the thread helix.



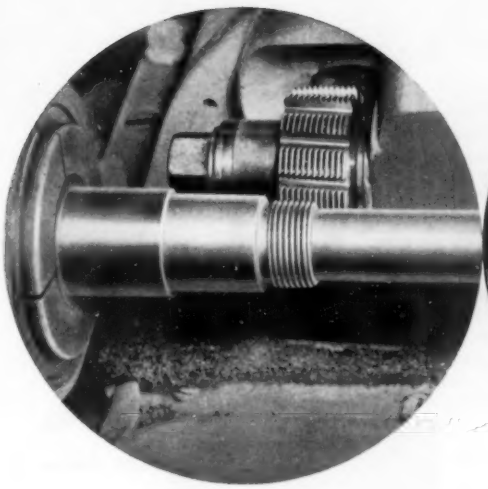
Large diameter cutters have greater length of contact and produce more pronounced fillets.

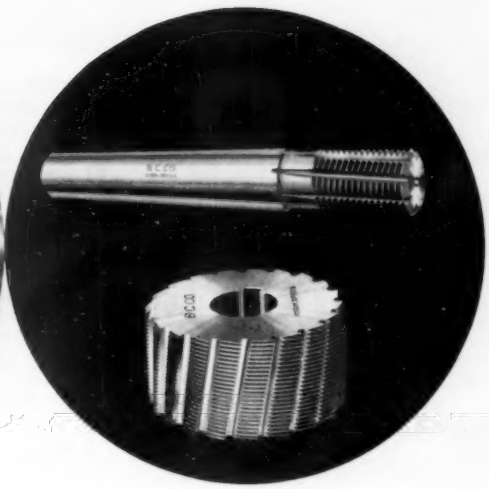


Small diameter cutters have less length of contact and produce smaller fillets.



In some cases, cutters mill deeper than true thread form. Any generated fillets which may be cut are then below the gaging surface of the thread. Correct cutter design takes care of this automatically.





original cutter accuracy in resharpening

All Barber-Colman form-relieved milling cutters are accurately index-sharpened on Barber-Colman automatic sharpening machines, so that all cutter teeth are the same height and accurately spaced. This makes it easy to maintain original cutter accuracy when resharpening either on automatic sharpeners, or on conventional sharpening equipment using the accurately indexed cutter teeth as a reference. In either case, accurate sharpening to original tolerances is easily maintained, and cutter sharpening time is reduced to a minimum.

design elements for maximum performance

With the proper tooth form developed to cut accurate threads, the engineers then analyze the job conditions to determine which cutter features will produce best cutter performance. These features include selection of the proper cutter material, shell or shank type cutters, straight or helical flutes, rake teeth, axial relief and intermittent teeth if sharp threads are desired. Since we make all classes of ground and unground thread milling cutters, we can recommend the cutter accuracy required for your job.

When you have a threading problem, consult Barber-Colman cutter engineers for their recommendations on the proper cutters for the job. Be sure the cutters you have are accurately designed to cut the correct thread form. Send us blueprints of your threaded parts for quotation on thread milling cutters designed to produce correct threads.

BARBER-COLMAN COMPANY

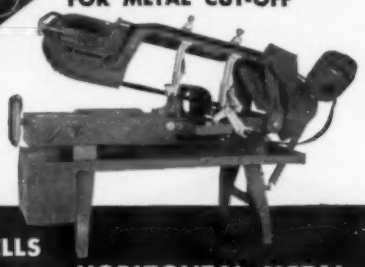
839 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

Announcing

A NEW PRODUCTION TOOL FOR METAL CUT-OFF



THE WELLS
MODEL 1000 HORIZONTAL METAL CUTTING BAND SAW

Here's the newest in the Wells quality line of metal cutting band saws—The Model 1000, a 10" capacity production machine powered by a ¾ H.P. motor. It offers the structural rigidity necessary for better cutting and operation and utilizes a 1" blade to further assure accuracy and efficiency.

The Model 1000 also features the exclusive Wells "constant load" blade tensioning device, four selective speeds, hydraulic frame check and optional wet cutting system.

See your Wells Distributor, or write for full details.

Wells

The Pioneers of Horizontal

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORP.

600 SERVICE ROAD • THREE RIVERS, MICH.

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CONCENTRIC LIVE CENTERS *the original, patented*

spring loaded live centers

AUTOMATIC THRUST ADJUSTMENT
Spring loaded spindle maintains constant tail stock thrust.

LONGER LIFE
Needle bearing distributes bearing stress over greater surface, thus holding close tolerances for much longer time.

FASTER SPEEDS
Smaller turning radius gives much higher RPM rate than ordinary live centers.

GREATER LOAD CAPACITY

LESS OVERHANG MEANS MORE RIGIDITY . . MORE WORKING RANGE

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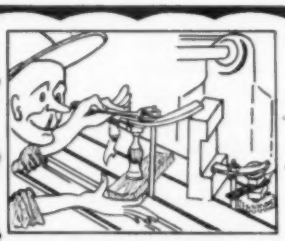

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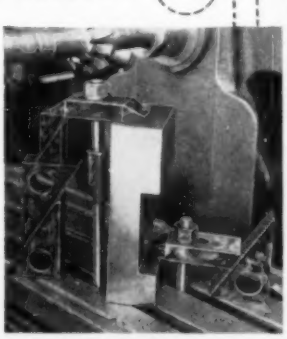
- T-NUT & STUD SETS—*12 SIZES*
- STEP BLOCK & CLAMP SETS—*5 SIZES*
- PUNCH PRESS SETS—*5 SIZES*



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TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 169.

Quality high speed steels
. . . still the best choice for dependable cutting tools

More Economical!
Tougher!
Less Chipping!
} *than carbide*

On countless applications, cutting tools made of quality high speed steel have given more economical, dependable service than carbide tools. The superior toughness of high speed steel results in more cutting versatility and minimizes tool chipping. High speed steel cutting tools perform well under variable chip load conditions with no need to "baby" the tool. Also, with proper sharpening and honing (comparative to that given carbide tools) phenomenal performance can be obtained from high speed steel.

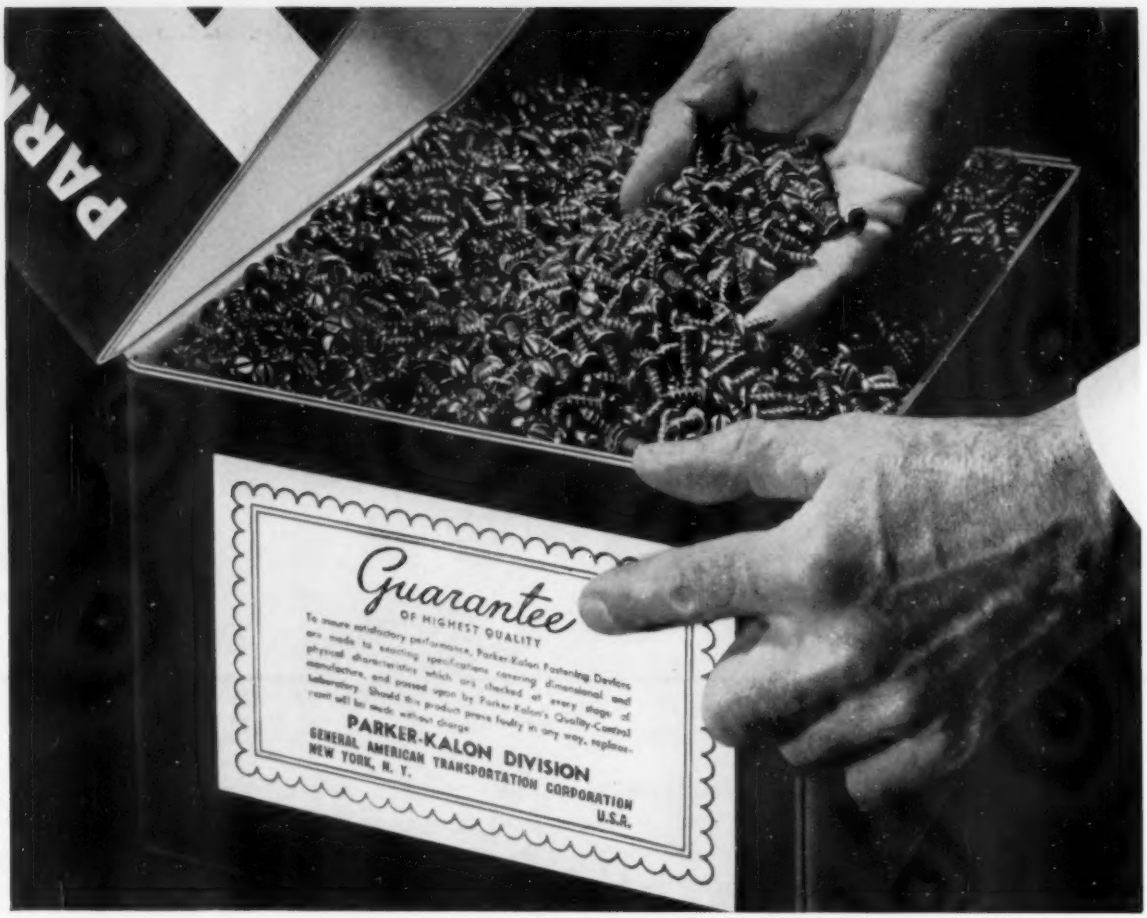
Latrobe's XL® high speed steels—*first in quality*

Latrobe's XL® high speed steels contain uniformly dispersed alloy sulphides for improved machinability and longer tool life. Also, as a result of Latrobe's exclusive DESEGATIZED® process of manufacture, both the alloy sulphides and the wear resistant carbides are evenly dispersed throughout the steel. This process assures full structural uniformity, higher edge strength and consistent response to heat treatment.

For dependable service . . . use high speed steel cutting tools!

Your nearest Latrobe representative will be pleased to furnish complete data on XL high speed steels.

LATROBE STEEL COMPANY
MAIN OFFICE and PLANT: LATROBE, PA.
BRANCH OFFICES and WAREHOUSES located in Principal Cities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OF HIGHEST QUALITY
To insure satisfactory performance, Parker-Kalon Fastening Devices are made to exacting specifications covering dimensional and physical characteristics which are checked at every stage of manufacture, and proved upon by Parker-Kalon's Quality-Control laboratory. Should this product prove faulty in any way, replacement will be made without charge.
PARKER-KALON DIVISION
GENERAL AMERICAN TRANSPORTATION CORPORATION
NEW YORK, N. Y.
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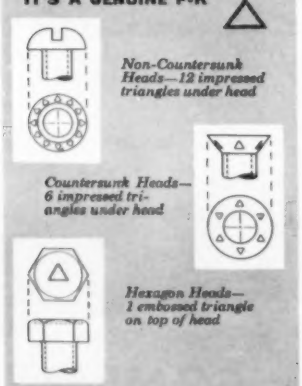
P-K® self-tapping screws **GUARANTEED**

to keep your assembly line humming

LOOK FOR THE TRIANGLE MARKS THAT TELL YOU IT'S A GENUINE P-K △


Non-Countersunk Heads—12 impressed triangles under head
Countersunk Heads—6 impressed triangles under head
Hexagon Heads—1 embossed triangle on top of head

You get a written guarantee of highest quality on every package

Pick up a package of P-K screws and open it. You'll see immediately that these are fasteners of outstanding quality. Read the guarantee —see the protection you get with P-K. The most important thing is the performance of P-K Self-tapping Screws. They're pointed, threaded, headed and hardened to start right, drive right and stay tight. That adds up to assembly savings for you—a smooth flow of production without wasted time and money caused by screw failures. That's why it pays to insist on the best—the screws that guarantee "if it's P-K, it's O.K."

PARKER-KALON DIVISION, General American Transportation Corporation

Manufacturers of Self-tapping Screws, Socket Screws, Screwnails, Masonry Nails, Wing Nuts and Thumb Screws

PARKER-KALON® fasteners

Sold Everywhere Through Leading Industrial Distributors

Factory: Clifton, New Jersey—Warehouses: Chicago, Illinois—Los Angeles, California

Because these solenoid covers are essential to valve operation, they are chained to the valves. Also, they fasten with 4 "captive" screws that cannot be mislaid. A manual operating button makes it possible to operate the valve without removing its cover.

Now! solenoid-controlled air valves that defy improper maintenance ...they won't operate with their covers off!

When a solenoid valve operates without its cover, trouble is not far off. Dirt, oil, cutting fluid, chips are sure sooner or later to jam the solenoid, and the valve will fail to shift.

That can't happen with these new Hannifin valves!

The solenoids are held in place by their covers and won't operate the valves unless the dust-tight, splashproof covers are firmly tightened.

These new valves, which conform to the latest J.I.C. recommendations, are part of the complete "P-M" Pilot-Master line. New heads with these new solenoid covers are offered on 2-way, 3-way and 4-way Pilot-Master Valves (air-operated). The smaller, direct-operated 3-way and 4-way valves in the "P-M" line have been redesigned to use the same new covers. This added feature is just another reason why it pays to standardize on Hannifin air control valves.

AIR CONTROL

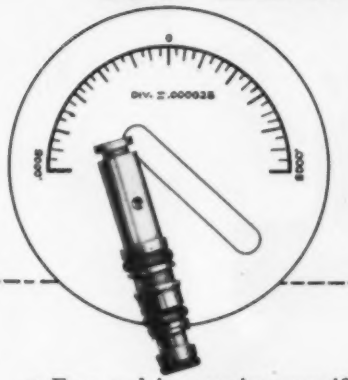
HANNIFIN

VALVES

Complete information on all Hannifin Air Control Valves is in this catalog. It belongs in your files. Write for your copy. Hannifin Corporation, 519 S. Wolf Road, Des Plaines, Illinois.

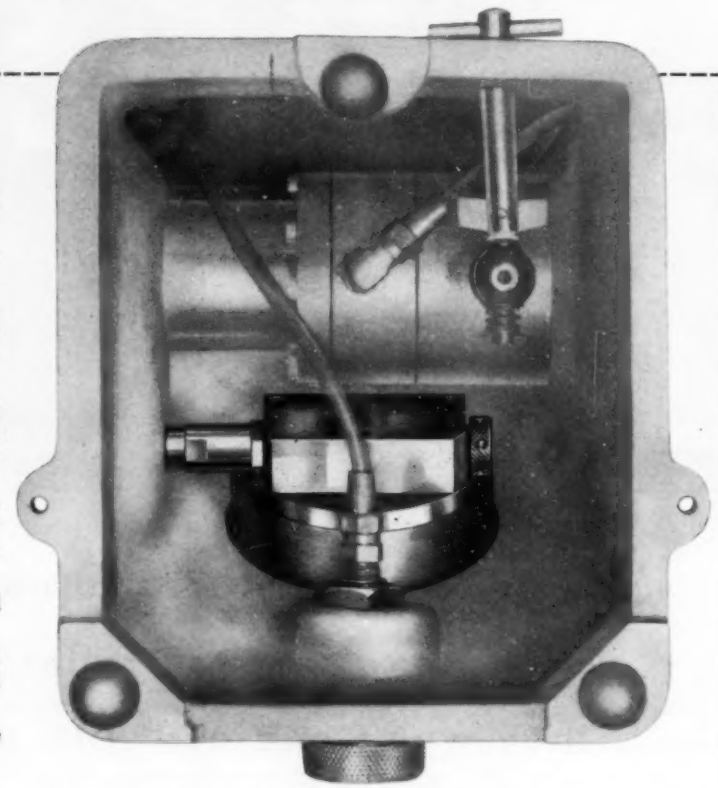
Get this Inside Story

for Lower-Cost Air Gaging



This simple venturi tube, and its corresponding dial, is the real key to more accurate, more trouble-free air gaging performance. The Taft-Peirce CompAIRator uses this tube in a unique *Venturi Circuit* which provides advantages not found in any other type of air gage. Check these exclusive extras . . .

- Easy and inexpensive magnification changes — switch this venturi and dial in just five minutes
- Only 10 pounds operating pressure, cuts air cost in half
- Fast reaction permits remoting base unit from fixture without using "booster" — no time lag or lowered sensitivity
- Velocity-type venturi circuit permits checking smallest diameters with standard gaging members — ID's down to .055″
- Wide tolerance range: can gage tolerances as narrow as .0001″, or can be designed to check as wide a range as .125″
- Full linearity through 180° of dial scale
- Built-in fast response, easily tied in with automatic machining and inspection operations
- Can be mounted at any angle without disturbing readings



Taft-Peirce Single Dial CompAIRator, complete with plug and masters. CompAIRators are also available in double or multi-dial units, can be used with standard air plugs, air rings, and air snap gages — directly attached to cabinet or to air hose. Special fixtures designed and built to order.

The simple Venturi circuit, extreme flexibility, and trouble-free operation make Taft-Peirce Air Gaging your lowest-cost quality control tool — whatever the production rate. It has been proved in hundreds of installations, performing all kinds of gaging operations.

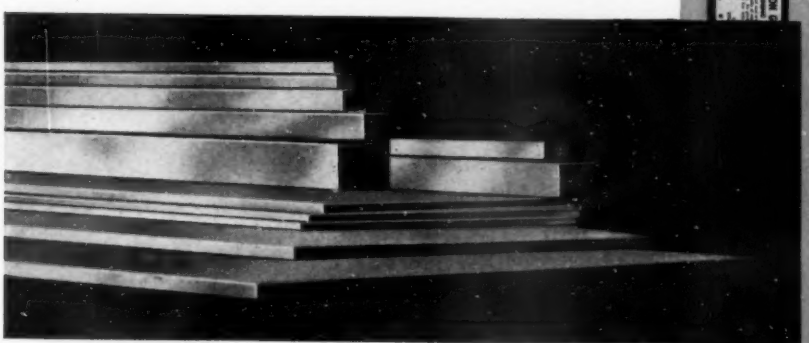
Get ALL the facts . . . from your nearest Taft-Peirce representative, or write direct for Air Gage Catalog No. 613.

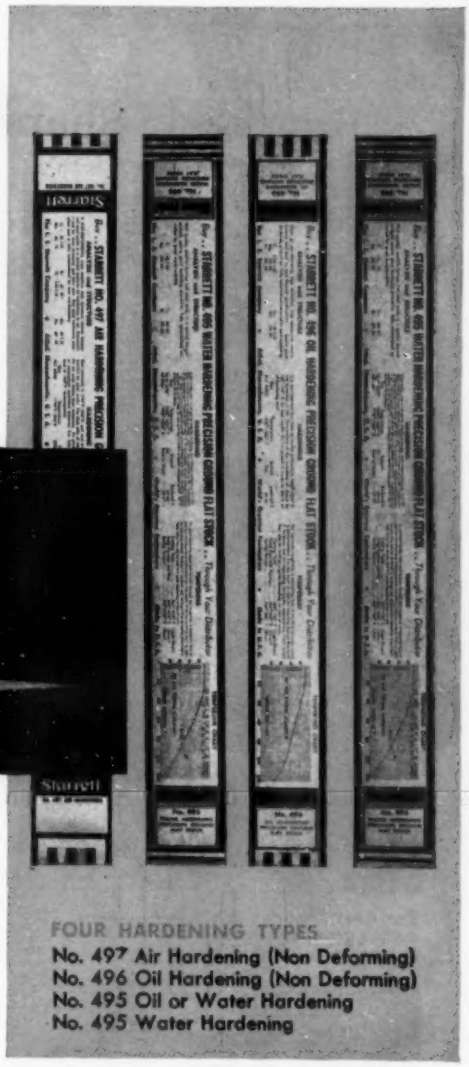
TAKE IT TO TAFT-PEIRCE

TAFT-PEIRCE MANUFACTURING CO.
WOONSOCKET, RHODE ISLAND

T-P Means TOP Precision

NOW OVER 1000 SIZES




FOUR HARDENING TYPES
No. 497 Air Hardening (Non Deforming)
No. 496 Oil Hardening (Non Deforming)
No. 495 Oil or Water Hardening
No. 495 Water Hardening

Starrett precision ground FLAT STOCK and DIE STOCK

Now it's easier than ever to save time and money by using Starrett Precision Ground Die Stock and Flat Stock. With over 1000 sizes available, you can make *all* your machine and fixture parts, special tools and gages, stamps, dies, cutters, templates this sensible, money-saving way.

Just think what it means . . . no time lost hunting up stock — no slow and costly grinding to size. Just lay it out and saw it out. Four types — air, oil, oil or water and water hardening — let you choose the hardening characteristics that fit your specific needs. Your Industrial Distributor has it. Specify *Starrett* to get the wide choice of sizes.

Flat Stock comes in 18" lengths, Die Stock in 36" lengths. Thicknesses from 1/64 to 3". Widths from 1/8" to 14". Each piece marked for type and size and individually packaged in protective envelope.

NEW FOLDER and WALL CHARTS

Catalog folder, desk chart and wall chart list all types and sizes with hardening formulas. Write for free copy. Address Dept. E

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Buy THROUGH YOUR INDUSTRIAL DISTRIBUTOR
Prompt delivery
Dependable service
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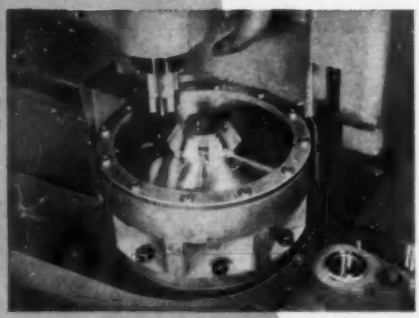
WORLD'S GREATEST TOOLMAKERS

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

SEE THE STARRETT EXHIBIT—SPACE 919—NATIONAL METAL SHOW

How Gear Shaper *Versatility* helps IMPROVE DESIGN

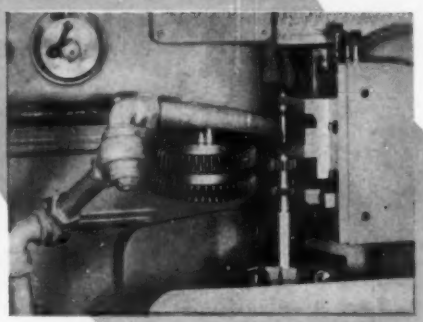


Quick-acting, air-operated diaphragm chuck speeds loading and unloading of pump rotor on Fellows No. 7A-Type Gear Shaper.

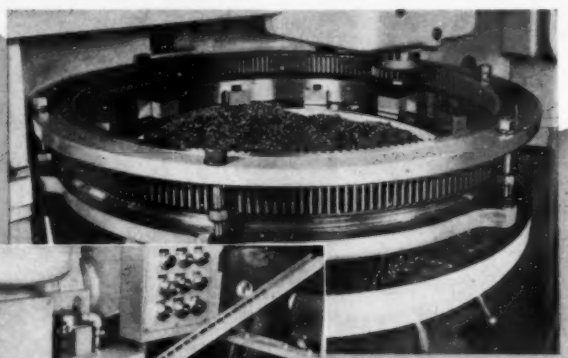
The Gear Shaper principle of generating with a reciprocating tool provides a versatile and economical method of manufacture which allows the engineer much greater latitude in the design of parts for low cost production. Special fixtures and controls permit cutting gears, intricate contours and other shapes in tandem or combination where otherwise, special-purpose machines might be required.

Free booklet — "The Art of Generating with a Reciprocating Tool" — shows in engineering detail how you can use Fellows Gear Shaper versatility to simplify and improve design. Write for it now.

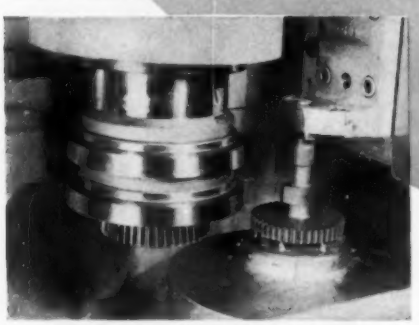
THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 319 Fisher Building, Detroit 2
5835 W. North Ave., Chicago 39
150 W. Pleasant Ave., Maywood, N. J.
6214 W. Manchester Ave., Los Angeles 45



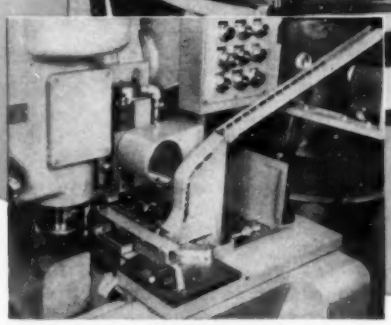
Two Gear Shaper Cutters in tandem cut automotive gears simultaneously. Center support fixture holds part in No. 4GS Gear Shaper.



Special fixture holds combination internal-external gear while internal gear is cut on 36-Type Gear Shaper.



Two cams and one gear are cut simultaneously on a gasoline motor part. Center support fixture holds part in No. 4GS Gear Shaper.

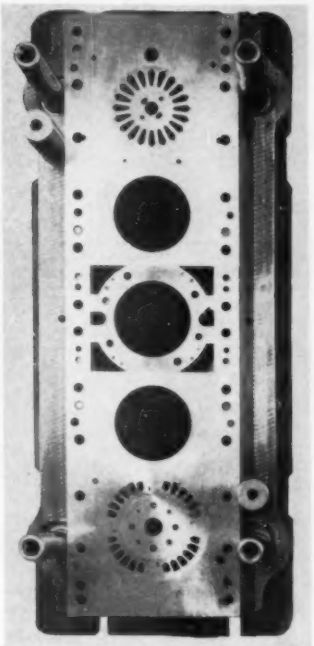


Fixture for automatically loading and unloading automotive pinions on the No. 4GS Gear Shaper.

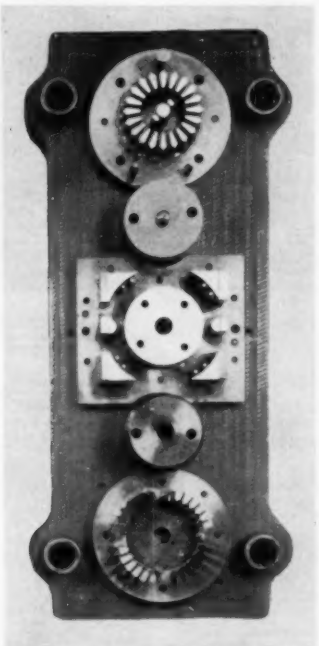
THE PRECISION LINE *Fellows* *Gear Production Equipment*

As shown in **LIFE** *magazine's Special Feature Series on* **AMERICA'S ARTS AND SKILLS, Part IX: Beauty in the Tools of Today**—*issue of May 21, 1956, page 99.*

Would it pay you to put *yourself* in this tooling category?



STENCILED DIE *with flowerlike patterns is used with the punch at right in an automatic machine which stamps out parts for air-conditioner motors.*



TOOTHED PUNCH *fits exactly into die at left. The basis for modern mass production, finely made parts like these are still shaped by hand craftsmen.*

Are you ready to join the special tool users we call *"the few who want the most"* in advanced precision? Must tolerances be held so close as to assure finished end-products accurate within ten-thousandths? Would it pay you to have precision as superior as a gem is to an ordinary stone?

If so, call on Ehrhardt. You will be in excellent company. LIFE magazine paid tribute to the Ehrhardt/St. Louis bench mark in choosing an Ehrhardt die and punch to help illustrate Part IX of its famous special feature series on *America's Arts and Skills*. Leading manufacturers for the electronics, aviation and automotive industries have used Ehrhardt's advanced precision for many years.

Everyday precision may be adequate, it is true, for many of your tooling requirements. But present-day tolerances would have seemed impracticable not long ago; and future precision will surpass today's. So, if you are now ready—or getting ready—to profit by *advanced* precision, Ehrhardt is ready to help you with triple plus service—which now includes the latest Elox electrical discharge machining!*

CARBIDE INSERTS *in this precision gage, kept within 40 millionths tolerance, insure the accuracy of our customer's finished product to within one ten-thousandth.*

**Profit by Precision*
Write today for
triple plus
...the new complete picture-story of what Ehrhardt's combination of tool-making skills and full range facilities can mean to you—in profits. Write—right now—for your copy.

Ehrhardt/St. Louis

Ehrhardt Tool & Machine Company, 914 Monroe Street, St. Louis 6, Missouri

A nation-wide service to the few who want the most in high-precision gages, dies, jigs and fixtures

over 8,000 Different Cylinder SELECTIONS—

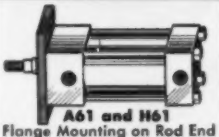
Miller AIR AND HYDRAULIC **CYLINDERS** AND BOOSTERS

"IN STOCK" for immediate delivery...

See Miller Bulletins A-105K (Air) and H-104K (Hydraulic) for Complete Dimensions and Engineering Data on these "in-stock" sizes and other Custom Miller Cylinders in bores up to 20" and strokes up to 22 feet.

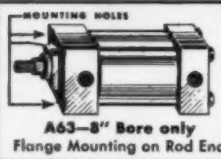
"IN-STOCK" MODELS

"A" Signifies Miller 200 psi Air Cylinders; "H", 2000 psi Hydraulic Cylinders. Interchangeable Mountings Are Shown in Rod On Drawings.

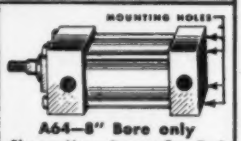


A61 and H61 Flange Mounting on Rod End (A61 not available in 8" bore)

A62 and H62 Flange Mounting on Cap End (A62 not available in 8" bore)

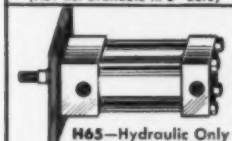


A63—8" Bore only Flange Mounting on Rod End

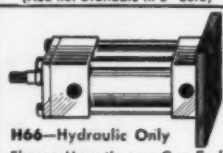


A64—8" Bore only Flange Mounting on Cap End

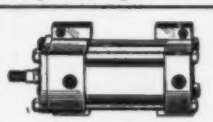
A50 & H50—Tie Rods not extended beyond nuts.
A51 & H51—Tie Rods extended both ends (shown).
A52 & H52—Tie Rods extended. Cap End only.
A53 & H53—Tie Rods Extended. Rod End only.
A54 & H54—Two Tie Rods extended at both ends.



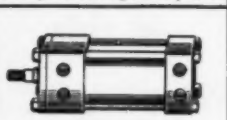
H65—Hydraulic Only Flange Mounting on Rod End



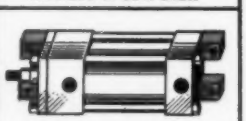
H66—Hydraulic Only Flange Mounting on Cap End



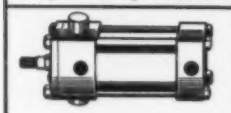
A72 and H72 Side Lug Mounting



A74 and H74 Side Flush Mounting

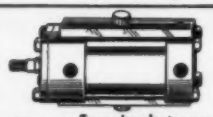


A77 and H77 Side or Foot Mounting

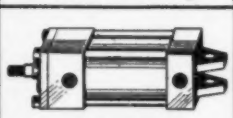


A81 and H81 Trunnion Mounting on Rod End

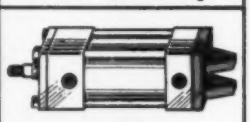
A82 and H82 Trunnion Mounting on Cap End



A83 and H83 Trunnion between Head and Cap (one week delivery)



A84 and H84 Pivot Mounting



A86 and H86 Pivot Mounting

IN STOCK BORES in Inches

	Bores	Rod Dia.	Rod Turn Down & Threads	"IN-STOCK" STROKES (in Inches)																					
AIR	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12									
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
	2	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	6	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	8	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
HYDRAULIC	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12									
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
	2	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1¾"	1¼-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	2"	1½-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36

(1) (2) (3) (4)

"A" and "H" Models 82, 84 and 86 with strokes over 18" require stop tubes.

Column strength requires larger diameter piston rods for the following:

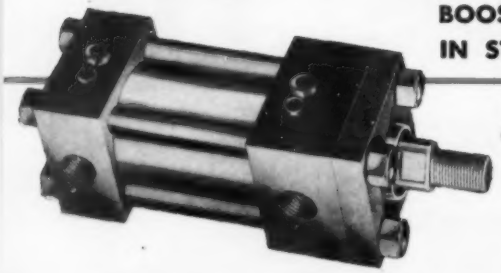
Air Cylinder Models A82, 84, and 86 with strokes inside area (1), when operated at 100 psi and over;

All hydraulic models with strokes inside area (2) and Models H82, 84, and 86 with strokes in area (4), when operated at 2000 psi and over;

Models H82, 84 and 86 with strokes inside area (3), when operated at 1000 psi and over.

Depending upon Trunnion Pin location, "A" and "H" Models 83 with standard diameter piston rods can have longer strokes than Models 82, 84 and 86.

See Miller File #251 for oversize piston rod and stop tube requirements.



BOOSTERS IN STOCK

Immediate Delivery on the following Miller 25 to 1 Ratio Boosters (80 psi air input produces 2000 psi hydraulic oil output): Model B4, 5" bore, 1" dia. ram, 6" and 12" strokes; Reciprocating Booster Model DA77-RBA8, 5" bore, 1" dia. ram, 6" stroke. Also Booster Tanks, 5" dia., 6" and 10" heights.

Write For Catalog and Stock Price List

Miller

MILLER FLUID POWER DIVISION
FLICK-REEDY CORP.

2010 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

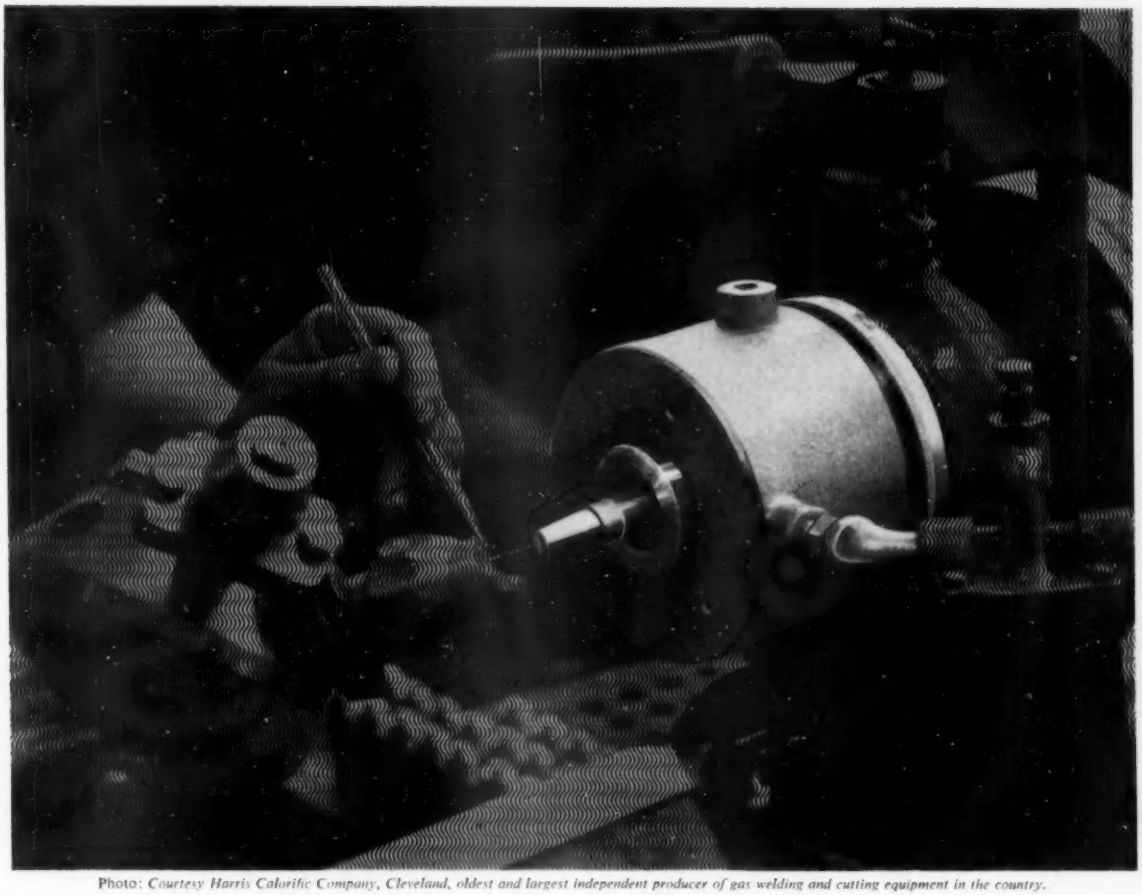


Photo: *Courtesy Harris Calorific Company, Cleveland, oldest and largest independent producer of gas welding and cutting equipment in the country.*

ERICKSON AIR CHUCKS

a hot tip for cutting costs on cutting-torch tips

Erickson '09 Model Air Chuck for heavy work. Quick-acting air chuck, with leverage principle, gives 3 to 4 times holding power of ordinary chucks.

"We have used Erickson Chucks since 1942 . . . and would recommend Ericksons to any plant which wants to increase production . . ." That is the report from Harris Calorific Company, big-name manufacturer of gas cutting and welding equipment.

The company uses four No. 400 Erickson Air Chucks for finishing leaded copper cutting-torch tips. Operations consist of drilling, reaming and polishing—at the rate of approximately *100 pieces per hour per chuck*.

Compared to previous methods, Harris Calorific Company claims, trueing-up time has been cut 70% . . . chucking time 60% . . . set-up time 25%.

Let an Erickson representative show you how to cut your production costs—*accurately*—with Erickson Air Chucks.

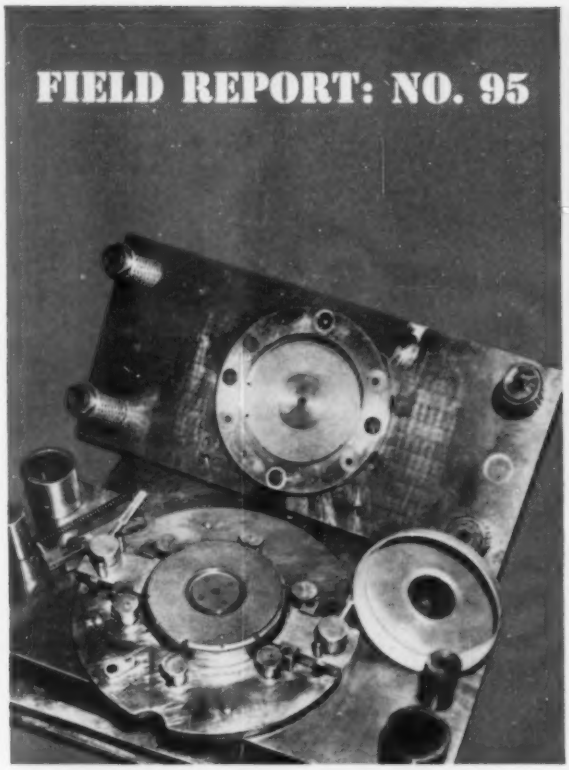
AA-5709

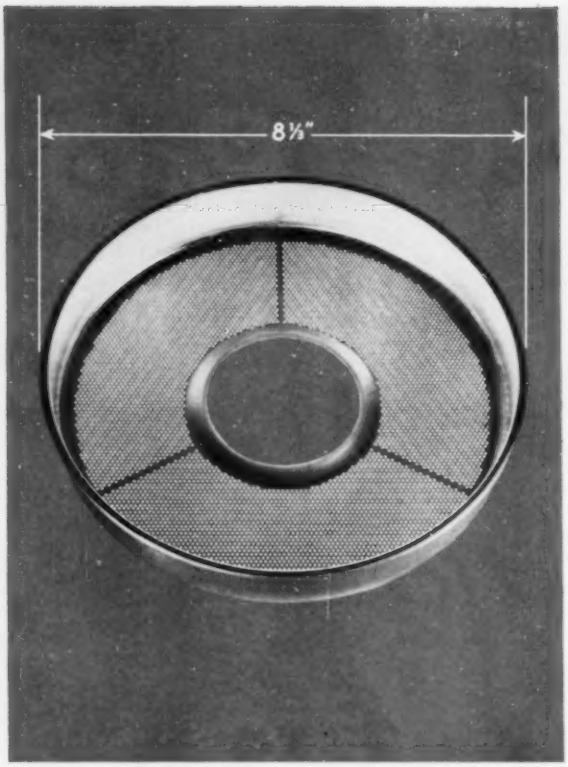
Bothered by a tough holding problem? Then let us show you how Erickson holding tools speed production, lower costs. Call us or write for Catalog K.

ERICKSON TOOL COMPANY

2303-9 Hamilton Avenue • Cleveland 14, Ohio

COLLET CHUCKS	AIR-OPERATED CHUCKS
FLOATING HOLDERS	EXPANDING MANDRELS
TAP CHUCKS	EXPANDING-COLLETS
TAP HOLDERS	SPECIAL HOLDING FIXTURES





WHICH DIE STEEL WOULD YOU USE

to be sure of getting 6,066 perfect holes in this die?

These tools are used in a 60-ton press to pierce 6,066 holes of .036" dia. in aluminum filter pans for a popular home appliance. The job demands "almost everything" from the die steel . . . good machinability and uniformity, minimum size change, extra safety in hardening and toughness to withstand heavy press loads.

The filter pans are 8⅓" in dia., and .025" thick. The 6,066 holes are perforated in three blows, as the die moves through three 120 degree indexing stations. Hundreds of machine hours are involved in drilling and taper reaming the tiny holes.

If the decision were up to you . . . on which die steel would you be willing to stake your reputation in view of this tough set of requirements?

In this Field Report from customer files, here are the amazing results: Working with Carpenter VEGA (Air-Tough) Die Steel, the company reports that not a single "hard spot" was encountered . . . *all 6,066 holes are in the die as planned.* The machining of VEGA was "considerably easier" than the machinery steel used for the stripper plate. What's more, there was no discernible change in size or shape after heat treatment . . . *the die held perfectly!*

You can count on good results from any Carpenter Matched Tool and Die Steel. Take the risk out of your tough tooling jobs. Call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor now for immediate delivery.

No. 610	HAMPDEN	K-W	STAR-ZENITH
No. 484	STENTOR	SPECIAL	T-K
VEGA	R.D.S.	SOLAR	No. 883

Carpenter STEEL

Matched Tool and Die Steels

The Carpenter Steel Company, 109 W. Bern St., Reading, Pa.

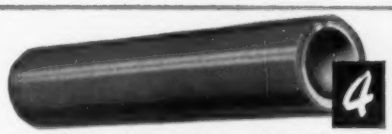
Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

7 WAYS to SAVE MONEY with TOCCO* Induction Hardening

Cost was reduced 94% when heat-treatment of this corn-harvester part was changed from carburizing to TOCCO-hardening, 9½c saved on every piece — $4750 on each 50,000 piece batch, plus an hourly production increase from 120 to 300 pieces per hour.

Leading automotive companies need and use TOCCO hardened axle shafts to handle higher horsepower. Better, yet cheaper—savings of $375.00 per day. Less machining costs, lower priced material, increased production, and a plus in quality—200% greater torsional life.

Kearney & Trecker Corp. reduced the cost of hardening this milling machine part from $1.57 to 10c apiece. In addition TOCCO made possible a switch from alloy to S.A.E. 1045 steel—saving another 11c per piece in material cost. Kearney & Trecker hardens 140 different parts on one TOCCO unit.



Thompson Products Ltd. boosted production of these automotive wrist pins from 500 to 1200 per hour when they switched to TOCCO-hardening. Costs fell from $5.45 to $3.25 per hundred parts—a savings of 2c per pin, $26.40 per production hour.

Mechanics Universal Joint Division of Borg-Warner reports a 69% savings in the hardening of stub ends for propeller shafts. TOCCO also upped production from 35 to 112 parts per hour—over three times as fast as conventional heating methods.

Lima-Hamilton Corporation adopted TOCCO for hardening this shifting lever. Results: a savings of 4c per piece—$25 per production hour. TOCCO costs only 17% of former heating method. This is only 1 of 139 parts TOCCO-hardened by Lima-Hamilton Corp. All show savings over usual heating methods.

7 Number 7—the lucky number—is up to you. Why not add your name to the list of companies who use TOCCO Induction Heating to increase production, improve products and lower costs. TOCCO engineers are ready to survey your plant for similar cost-saving results—without obligation, of course.

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SAVE on precision DIAL BORE GAGES

Save 25% by purchasing these beautifully designed, long lasting NILCO Dial Bore Gages in sets!

Save on production costs! Operators using NILCO Dial Bore Gages see the condition of the holes and control the size right at the machine. Better parts and fewer rejects are the result.

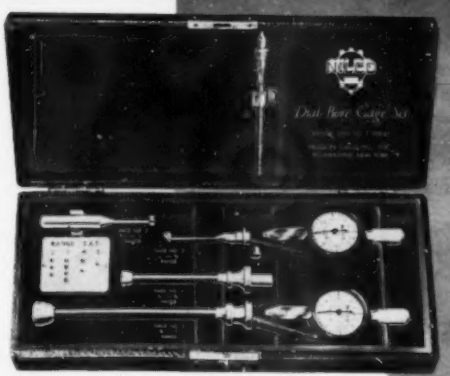
SMALL SHOPS. A set gives small shops large shop precision. No other type of equipment necessary for present or future requirements.

LARGE PLANTS. Ideal for inspection, experimental departments, tool rooms, and receiving inspection departments where it is uneconomical to use numerous individual gages.

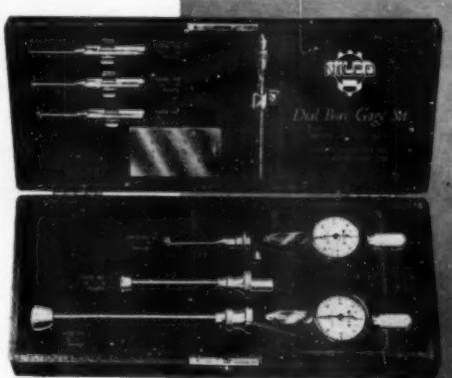
SUBCONTRACTORS. Where runs are varied and quantities small or large, a set will solve all bore gaging problems now and in the future.

QUALITY CONTROL. Gages show the exact size of the parts in .0001". Instantaneous, accurate reading allows quick compilation of data for quality control, anywhere in the plant.

All gages in these sets (and also larger ones) are available as individual gages. For complete information and prices: Write to Nilsson Gage Co., Inc., Poughkeepsie, N. Y.



4 GAGE ECONOMY SET complete in case Range 3/16"—1"—3 point alignment—2 point measurement principle used in all gages.



6 GAGE ECONOMY SET complete in case Range .090"—1".

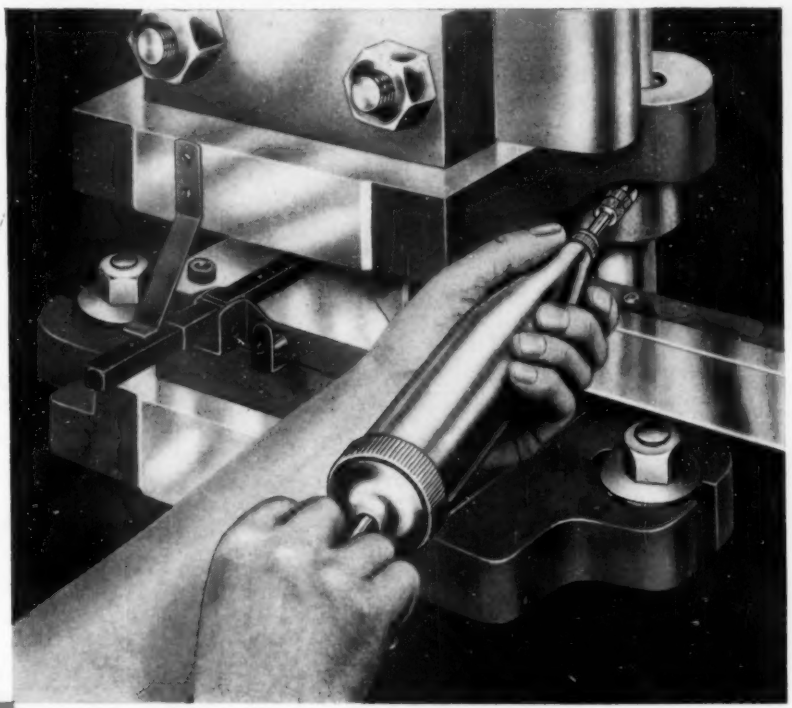
no special skill required!

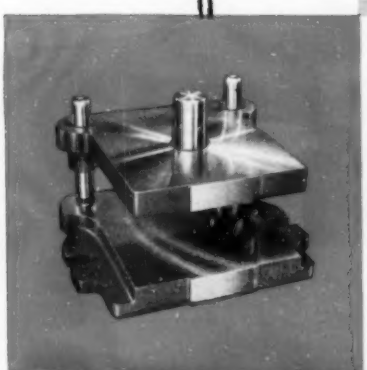
Simple to set, simple to use. No bothering with electricity, air connections, elaborate devices or expensive attachments. Simply place gage in the hole and read.

NILSSON GAGE CO., INC.

Poughkeepsie, New York

NEW oil lubrication system





DANLY

ON NEW DANLY DIE SETS

Here is another example of Danly leadership in die set design . . . the new oil lubrication system for guide posts and bushings. The illustration shows how easily a lubrication gun reaches the oil fitting in the shoulder of the bushing. Once injected, oil fills figure-8 oil grooves in the bushing to assure uniform lubrication for protection that lasts even through long press runs . . . less frequent oiling is needed, the job is done faster. Isn't this new lubrication system another important reason why you should specify Danly die sets?

complete new "leadership line" catalog

More than 200 pages provide you with more complete design information, easier selection of die sets and supplies. Write for your copy today!

DANLY MACHINE SPECIALTIES, INC.

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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-303

REDUCE
PIN DEFLECTION
AND DIE MAINTENANCE
with SUPERIOR
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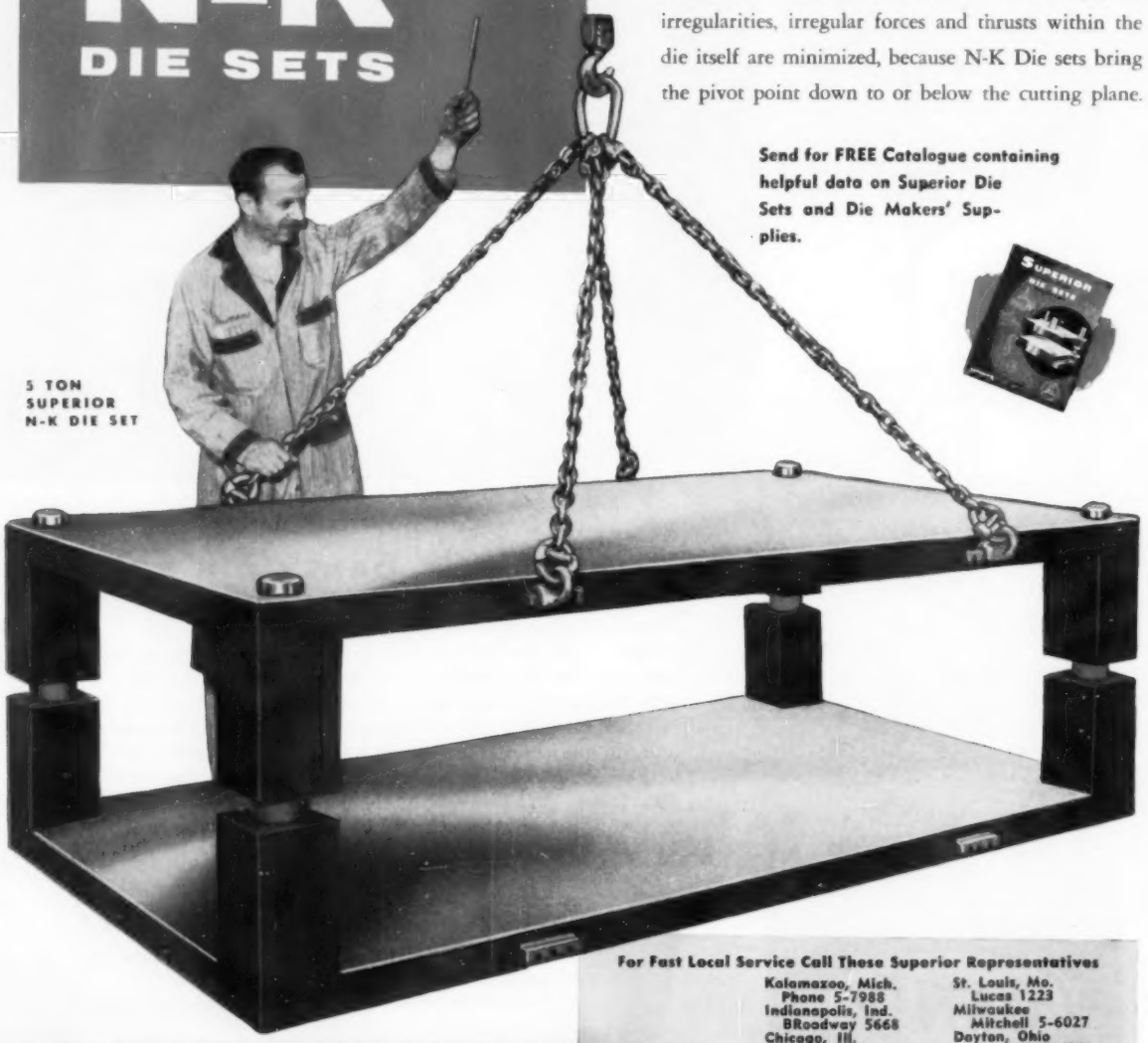
Overcome Forces that Cause a Die to Shear Itself, Chip Its Cutting Edges, Break Punches, Produce Irregular Break Lines and Cause Large and Irregular Burrs on the Parts Produced.

Superior N-K Die Sets incorporate welded bosses around pins or bushings to increase the accuracy and durability of the die set. These welded bosses shorten the unsupported pin length which in turn greatly reduces pin deflection. Misalignment caused by press irregularities, irregular forces and thrusts within the die itself are minimized, because N-K Die sets bring the pivot point down to or below the cutting plane.

Send for FREE Catalogue containing helpful data on Superior Die Sets and Die Makers' Supplies.



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For automation as for regular production, Circle **R** saws and other circular metal-cutting tools prove the best you can buy — though they cost no more.

- **CIRCLE R** Specialized Facilities comprise 45,000 square feet — devoted *exclusively* to development and production of circular metal cutting tools.
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CIRCULAR TOOL CO., INC.
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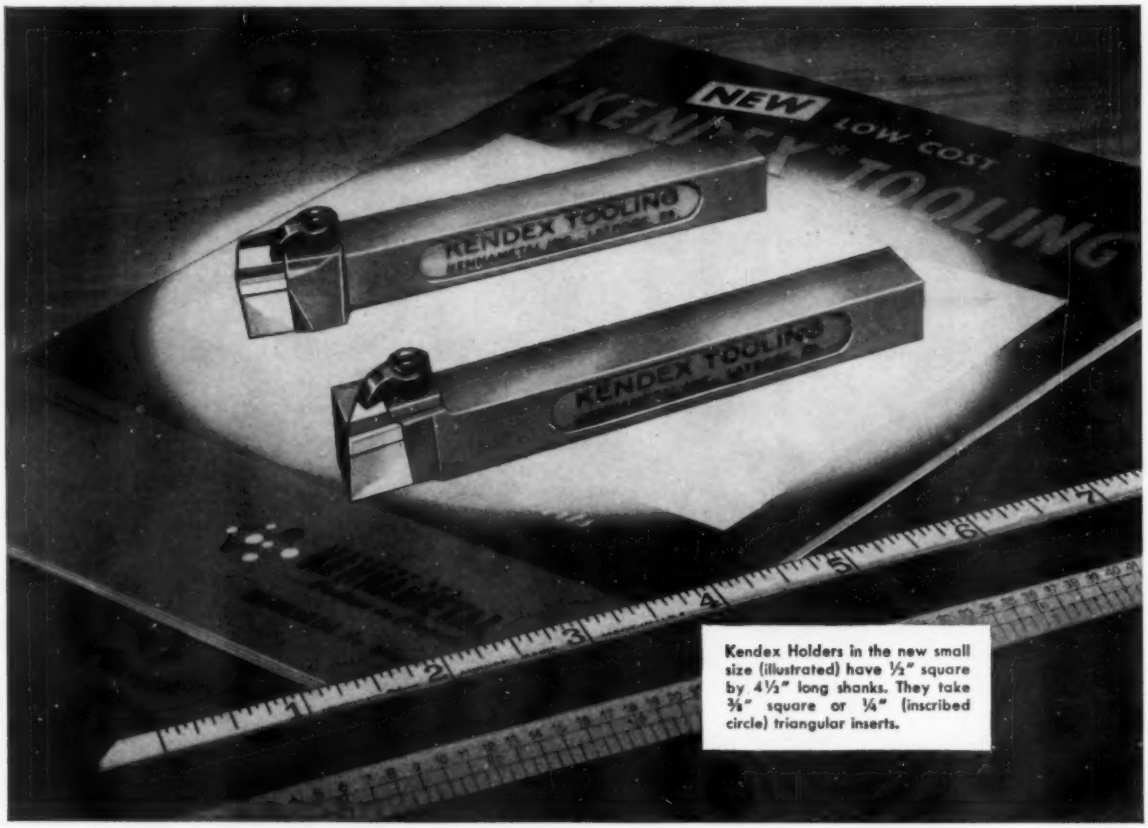
Specialists in Circular Cutting Tools Since 1923



Kendex Holders in the new small size (illustrated) have ½" square by 4½" long shanks. They take ⅜" square or ¼" (inscribed circle) triangular inserts.

NOW, small Kendex* Button Tools with turnover "throw-away" inserts

...for light machining on high production operations
...especially useful for boring operations

Another variation of the popular Kendex Tooling is now available. This is the new ½" Kendex Holder, available in four styles, for use with triangular or square Kennametal* "turn-over" button inserts . . . making available small tools with the many advantages and economies of the Kendex principle:

- grinding is eliminated
- inserts are indexed quickly to each new cutting edge
- machine downtime is reduced to a minimum
- production is increased

If you are interested in small-sized, rugged, dependable clamped-type tooling, ask your Kennametal tool engineer to show you how these small Kendex holders can be used to advantage on your operations. Or write for Booklet 301. KENNAMETAL INC., Latrobe, Pennsylvania.

*Registered Trademark

B-5078

Small-sized Kendex Tools are equipped with Kennametal chip breakers and solid Kennametal seats to back up inserts.

Kennametal inserts for small Kendex holders are stocked in a number of grades including the new K7H grade for high velocity operations and for machining heat-treated or high tensile steels.

Tell us your small-tool problem and our tool engineers will help you select the right tool and grade of cutting edge.

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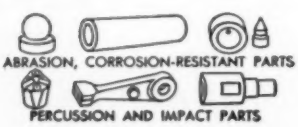
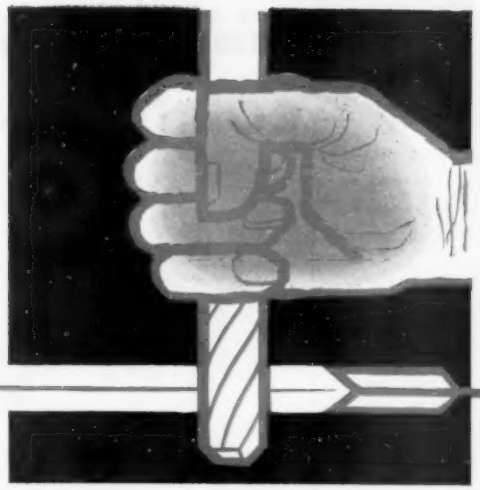
...Partners in Progress





positive
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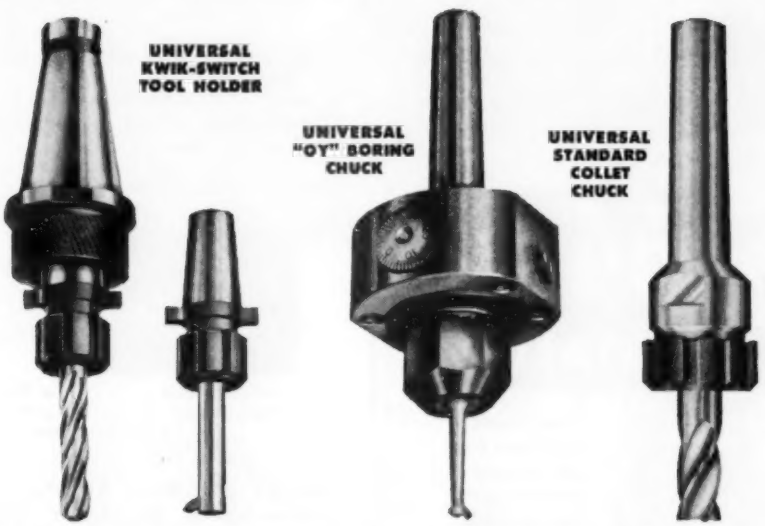

A sure, solid grip on tools is provided by the wrap-around action of Universal chucks because the slotted collet grips the tool on a continuous surface the full length of the collet. This positive grip, plus the precision manufacturing of all Universal chucks, keeps tools running true to .001" within an inch from the nose of the chuck. Our simplified chuck design eliminates auxiliary bearings, resulting in low cost to you. Sizes range from 1/16" to 1 1/2", with shanks to fit any machine. For complete information on these three or other Universal chucks, write the office nearest you: Universal Engineering Sales Co., 1060 Broad St., Newark, N. J., 5053 Sixth Ave., Kenosha, Wis., or our home office in Frankenmuth.

UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 3, MICHIGAN

195

Extra FAST SET-UP METHOD

Types to fit any machine used for tapping or reaming.

You'll find it amazing how much less time it will take you to make tapping and reaming set-ups if you use a Ziegler Tool Holder instead of an ordinary tool holder.

Imagine being able to make a set-up that comes only within 1/32" of center on the radius and still call it a day! You can if you use a Ziegler Holder—because the Ziegler is so designed that it automatically compensates for the inaccuracy.

Get a Ziegler Holder and see how it simplifies and speeds up the making of set-ups for tapping and reaming.

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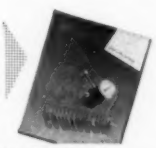

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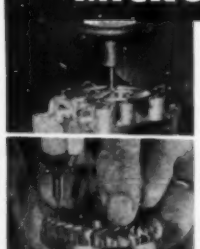

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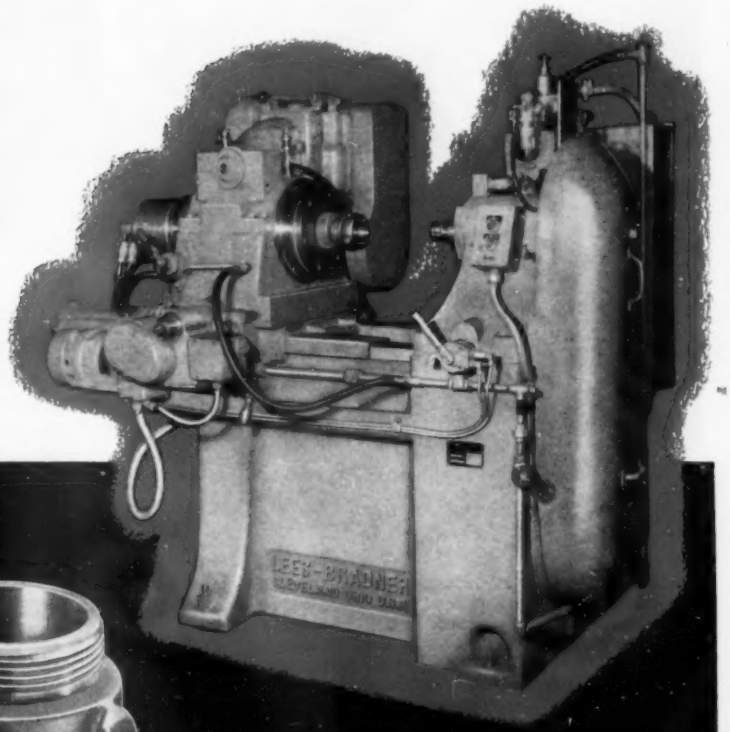


The Lees-Bradner Special High Speed Thread Milling Machine

The Lees-Bradner Special Thread Milling Machine really shows its class when it works with brass!

The Akron Brass Manufacturing Company of Wooster, Ohio produces these threads, internal and external, each in 13 seconds with a 5000 RPM cutter spindle speed.

This is just one example of the many threading jobs that the modern, high speed, Special Thread Milling Machine can do better, faster and with unmatched precision.

Write The Lees-Bradner Company for full information on this remarkably versatile machine.

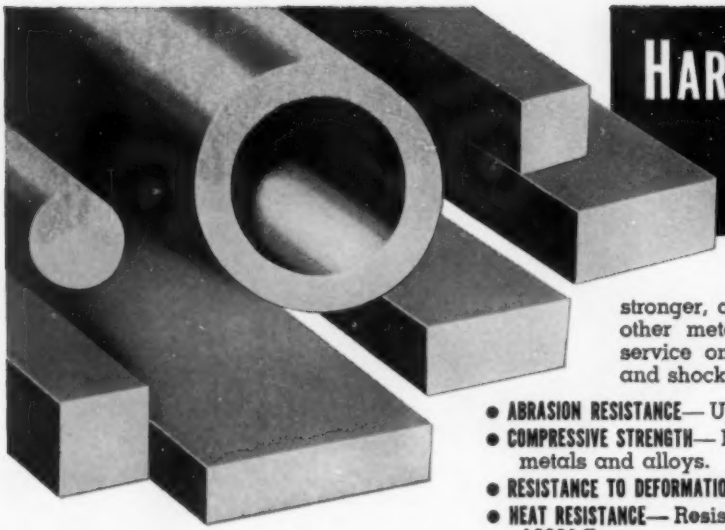
DETAILS ON THIS JOB

Hob Spindle Speed, 5000 R.P.M.
(Using a high speed cutter spindle)

Thread Pitch (internal and external)	7½
Thread Diameter	3"
Length of Thread	¾"
Threading Time	13 seconds
Material	Brass
Weight of Parts	
Internal thread	1 lb. 13 oz.
External thread	2 lb. 10 oz.

the LEES-BRADNER Company

CLEVELAND 11, OHIO • U.S.A.



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- **THERMAL EXPANSION**— Less than half the rate of steel, "creep" is negligible.
- **FRICTIONAL RESISTANCE**— Lower than steel, non-galling, "slippery" properties higher.

TALIDE METAL is saving industry millions of dollars annually by wear-proofing vital parts on machine tools, presses, pumps, compressors and other types of processing equipment used in the steel, oil, chemical, plastic, auto, rubber, textile, glass, mining and metal-working industry. The physical properties of the most commonly used grades are listed below. Other grades are available for specialized applications.

PHYSICAL PROPERTIES OF TALIDE METAL (P. S. I.)

Application	Operation	Talide Grade	Rockwell "A" Hardness	Specific Gravity (Density)	Transverse Rupture Strength	Compressive Strength	Co-Efficient of Thermal Expansion	Modulus of Elasticity (Deflection)
WEAR SURFACE	No Shock	C-91	91.8	14.90	235,000	710,000	3.00x10-6	91,000,000
	Light Shock	C-99	91.0	14.75	265,000	670,000	3.65x10-6	84,000,000
	Medium Shock	C-88	89.5	14.55	295,000	635,000	4.00x10-6	80,000,000
IMPACT	Light	C-85	88.4	14.25	315,000	600,000	3.75x10-6	77,000,000
	Medium	C-80	87.0	13.85	335,000	550,000	4.50x10-6	74,000,000
	Heavy	C-75	85.0	13.15	355,000	500,000	5.00x10-6	70,000,000

Note: Hardness values may vary plus or minus .2 to .3 on individual lots.

All TALIDE METAL grades are made in latest type vacuum electric furnaces by precision methods under rigid control. A wide variety of shapes and sizes can be supplied—up to 25" in diameter, 100" in length, and 5000 pounds by weight. Parts can be supplied to any grit finish required down to one micro-inch.

Metal Carbides Corporation,
Youngstown 12, Ohio.

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the perfect combination...
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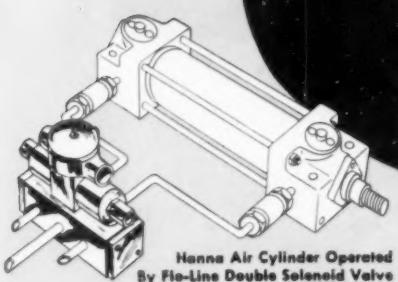
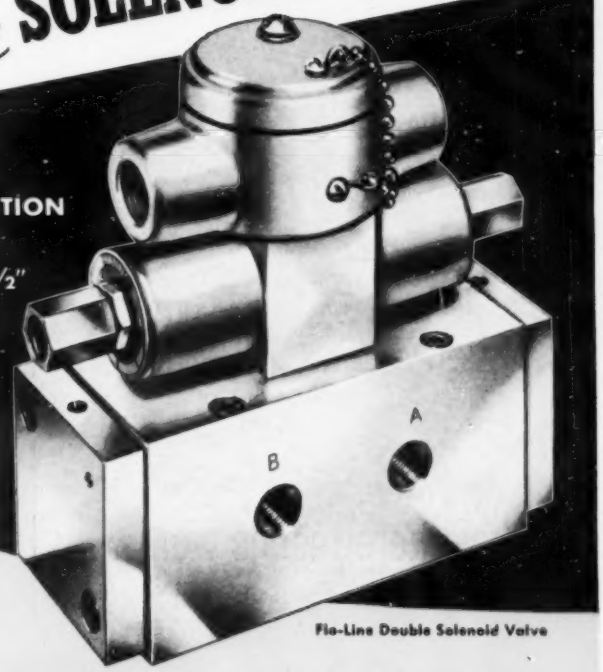
UP TO 150 PSI
SIZES: 1/4", 3/8", 1/2"



Hanna Air Cylinder Operated By Flo-Line Double Solenoid Valve With Flo-Set Speed Control Valves



Flo-Line Double Solenoid Valve

Hanna has designed and built new and unusual features in their Flo-Line Solenoid Valves . . . features that result in economy, more versatile operation and safety. Here are some of them:

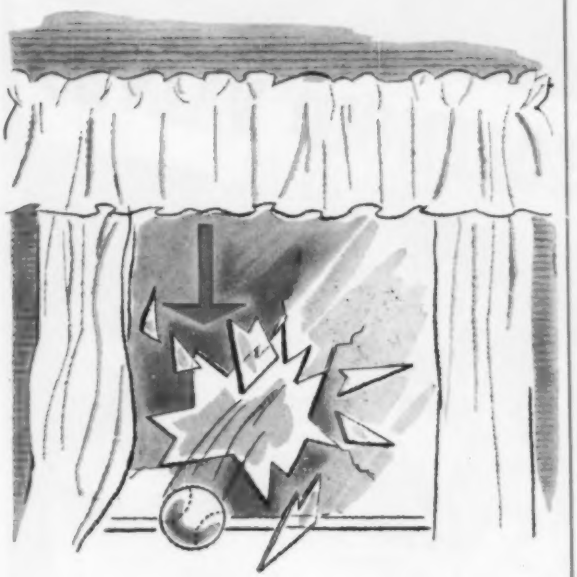
- **Bubble Tight Spool** positively sealed by "O" rings.
- **Dust-Tight, Splash-Proof Design** to seal out dirt and moisture, and assure trouble free performance.
- **Few Moving Parts** for longer valve life.
- **Full Pipe Capacity** for all internal passages.
- **Wide Range of Temperatures and Pressures** —40° F. to 125° F.; 20 to 150 psi air. Options permit air pressure to 250 psi and even vacuum!
- **Enclosed Solenoid Coils** for safe operation.
- **AC or DC Service,** coils are available for most voltages and frequencies.
- **Meets JIC Recommendations** in all respects when ordered with optional manual over-ride.
- **Side or Manifold Porting** for easy installation and convenient piping.
- **Choice of Spools** permits selection of a standard valve for most applications.
- **Manual Over-ride,** an optional feature, allows equipment to be tested before final electrical installations are made and provides a means of operating the valve in case of electrical failure.
- **Junction Box** for ease in making electrical connections.
- **Modern Clean Cut Appearance**

You'll surely want the complete details given in the new Hanna Flo-Line Catalog No. 261. See your classified telephone directory or Thomas' Register for the name of your nearest Hanna Representative—or write us direct.

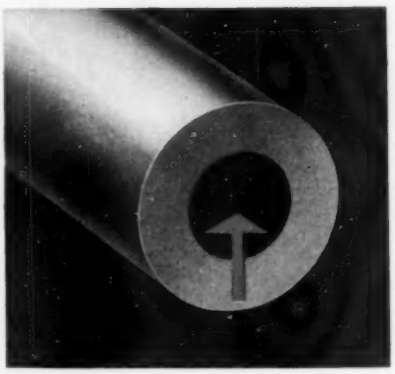
Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT • CYLINDERS AND VALVES

1768 N. Elston Ave., Chicago 22, Illinois



a hole here means work...



a hole here saves work

Crucible Hollow Tool Steel Bars take much of the work out of making ring-shaped steel parts, or tools with a center hole. The hole's already there. You save expensive drilling, boring, cutting-off and rough-facing operations . . . you reduce machine time and scrap losses.

You can now get Crucible Hollow Tool Steel Bars in any of the famous Crucible tool steel grades, in virtually any I.D. and O.D. combination. And you can get *immediate delivery* from stock of the five most useful grades — KETOS oil-hardening . . . SANDERSON water-hardening . . . AIRDI 150 high-carbon, high-chromium . . . AIRKOOL air-hardening . . . NU DIE V hot-work tool steels.

Your Crucible representative can quickly show you how Crucible Hollow Tool Steel Bars will save you work and money. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

AIR CYLINDERS of many kinds are made by Schrader. One type is shown above and in the photo below. Here, used to exert a ton of force, the cylinder bends rods easily into shape. Schrader makes air products to fit needs of almost any operation. A few of them are indicated here in red (numbers 1 through 3).

How Schrader Air Products help make

4 times as many burner grills per hour

Bending metal rods for kerosene burner grills requires a ton of force at Barridon Oil Burner Corporation in Hartford, Connecticut. Before air was adapted to the job, only 150 pieces per hour could be produced. Now, with the help of Schrader Air Products, 620 pieces are produced every 60 minutes.

This kind of production help is typical of operations automated with Schrader Air Products. Every day, new ways of using air for automatic operations are being planned, tested, and integrated in many different kinds of manufacturing plants. Economy, efficiency, and safety are basic with air, and in many cases air has made the difference between profit and loss.

Schrader engineering facilities are available to help you. Upon request, Schrader engineers will assist in planning for the most efficient use of air in your plant. Outline your problem to us and we'll give you prompt help. Right now—send for the latest informative booklets which show Schrader Air Products that can increase production, at low cost.

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FIRST NAME IN THE USE OF AIR
FOR INDUSTRIAL PRODUCTION AND CONTROL

JOHN L. COLLYER

Portrait by Fabian Bachrach

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"Thrift is one of the keys to our continued prosperity. It builds security for the family, retards inflation and stabilizes the purchasing power of the dollar. I am proud that Ohio is a leader in this worthwhile endeavor and that it has been my privilege to serve since 1950 as State Chairman of the Payroll Savings Advisory Committee."

JOHN L. COLLYER, ***Chairman***
The B. F. Goodrich Company

A simple person-to-person canvass that puts a Payroll Savings Application Blank in the hands of *every* employee is all you have to do to install the Payroll Savings Plan or build employee participation in your present plan. Your State Sales Director is ready to help you. Write today to Savings Bond Division, U. S. Treasury Department, Washington 25, D. C.

The United States Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

American Society of Tool Engineers
10700 Puritan Avenue Detroit 38, Michigan

Talking About Die Sets

with
Phil Marsilius
Vice-President
The Producto Machine Co.

Master or Commercial: What Makes the Difference? The most obvious difference between a Master (Precision) set and a Commercial set is the price. The Commercial set costs less because less assembly time is required in its manufacture. Punch holder and die holder tolerances are the same for both grades of die set. However, extremely close tolerances for fit between pins and bushings on Master sets require more accurate honing of bushings in assembly. Master die set tolerances for parallelism between punch and die holder are also more critical than those for Commercial die sets.

Normally, the difference between pin and bushing diameters on die sets manufactured by our industry is never less than .0002" and ranges as high as .0009". There are die sets made to closer or looser tolerances than these, but generally speaking, the majority of die sets fall into this category.

Master die sets are manufactured to the low side of this tolerance scale and are held to a maximum of .0004" differential. This closer tolerance increases the useful life of precision sets by allowing for wearing of the pins and bushings in operation.

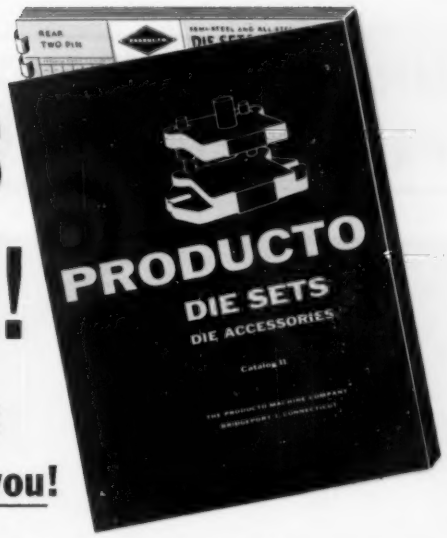
Commercial die sets are made throughout the entire range of this tolerance scale and, more often than not (to reduce assembly cost), are made to the higher tolerances. As a result, their accuracy will usually decrease much faster than that of Master die sets. While it is possible with this tolerance range to receive a Commercial set with the minimum pin and bushing fit allowed, you can be certain of longer die set accuracy only with a Master set, which is guaranteed to be held to the low side.

A "free-sliding fit" is one that permits the punch holder to move down on the guide pins of its own weight. It does not have any bearing on the degree of accuracy of the die set since a free-sliding fit can be supplied on both Master and Commercial sets. On Master sets, however, it is sometimes necessary to hone out the bushings to a full .0004" tolerance to provide a free-sliding fit.

EVERY die set MUST, of necessity, work freely in normal use, *on the press,* but catalog die sets should come apart and go together easily for bench work. With an occasional exception (when sets are made to the lowest tolerance for fit allowed), disassembly should be possible by hand without use of separating tools.

In making a choice, the degree of accuracy required and the life requirements of the die set should be the main points of consideration which determine whether you should order a Master or Commercial die set.

IT'S HERE!



A new catalog designed for you!

WRITE FOR YOUR COPY TODAY

Here, at last, is a die set catalog that makes your selection and ordering really easy. Producto's all-new catalog is compact for the die designer, convenient for the purchasing agent, a functional tool for the die maker.

These unique features make Producto's catalog much easier for you to use:

IT'S COMPACT. Though many items have been added, it has *fewer* pages because superfluous material has been eliminated. New products include Qwik-Fit Guide Pins, new Bushings with grease fittings, Lamina Bushings, Ring Punches and Dies, Toolroom Equipment, Lubrication Accessories and new Die Spring Selections.

IT'S COMPLETE, containing the greatest selection of die sets and accessories that has ever been offered to date.

ALL PRICES ARE NET and appear in a *separate pricing supplement,* removed from the technical section. No more time-consuming "discount" calculations.

NEW BINDING ARRANGEMENT lets you look at technical and pricing information *simultaneously.* No more flipping pages back and forth to get complete information.

STREAMLINED PAGE LAYOUT makes it easier for you to find essential data. Color highlights catalog numbers and drawings.

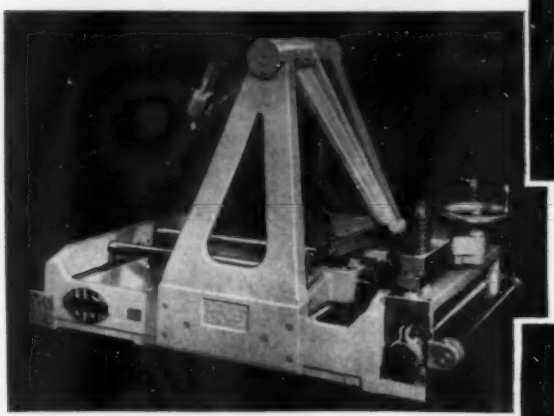
To make your die set ordering as painless as possible, write today for a free copy of Producto's new Catalog No. 11.

THE PRODUCTO MACHINE COMPANY
930 Housatonic Avenue, Bridgeport 1, Connecticut

Wherever die sets are used
PRODUCTO
PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

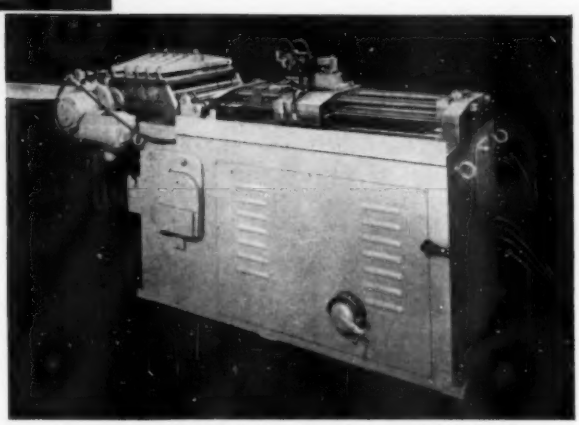
UNCOVER THE HIDDEN PROFITS IN YOUR PRESS ROOM!

U.S. Slide Feed, Plain Straightener, and U.S. Multi-Roll Cradle used in conjunction with conventional O.B.I. Press.



Smallest and largest sizes of U.S. Slide Feeds which we now build. To the left, Model SF-24-24 capable of handling material up to 24 inches in width, with feed length adjustable up to a maximum of 24 inches. To the right, Model SF-00 capable of handling material up to 1½ inches in width with feed length adjustable up to a maximum of 1 inch.

WITH U.S. AUTOMATIC PRESS ROOM EQUIPMENT



SFC-24-24 U.S. Cabinet Mounted Individually Motor Driven Slide Feed capable of handling material up to 24 inches in width, with feed length adjustable up to a maximum of 24 inches at one stroke. Equipped with Stock Straightener with a pair of Motor Driven take-in rolls suitable for material up to .060 in thickness. This feed can be cycled to obtain feed lengths over 24 inches.

By converting your presses into automatic machines you are able to reduce piece part costs. You, like all other manufacturers, are interested in attaining this end result. The units illustrated are only a few of the different types of Feeds, Straighteners, Coil Cradles and Stock Reels included in our line. These and our other units have been designed and built with the end result of "Automatic Operation" in mind.

The use of this equipment gives you the double advantage of increased production and reduced labor costs, plus the feature of flexibility. Within their capacity, U. S. Slide Feeds can be easily adapted to handle materials varying in width, thickness and length of feed. Furthermore, U. S. Slide Feeds are designed so that the length of feed is controlled between positive stops providing consistent accuracy that is especially desirable in progressive die operations.

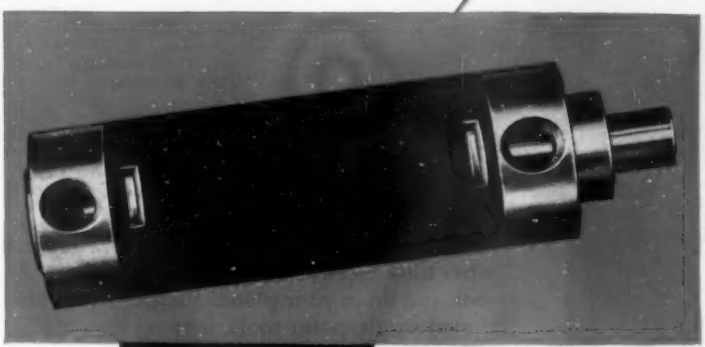
If you use presses in your production program, be sure to write for a copy of our Bulletins No. 80-T and 90-T illustrating and describing U. S. Automatic Press Room Equipment.

U. S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides — U. S. Multi-Millers
U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories

Fit Like a Cartridge in Close Quarters



O-M CYLINDERS TIE-RODLESS

(150 PSI AIR—UP TO 1500 PSI OIL)

These compact, streamlined cylinders, that require ⅓ less installation space than the conventional type, slip easily into the hard-to-reach places, because the O-M Special Interlocking Mechanism eliminates both tie-rods and projecting end caps. Besides, the precision honed, seamless steel cylinder body can be turned down to fit in unusually tight spots.

Other important features that reduce maintenance costs and step up efficiency include:

- ***Two point Bearing,*** one on piston and one in rod gland provide better balance and protect against drag on rod—giving O-M the lowest co-efficient of friction at low or high speeds;
- ***End Covers*** (head) machined steel;
- ***Leather Back-ups*** on Hydraulic cylinders prevent extrusion on end plugs—O-ring seals;
- ***Piston Packings***—self-adjusting U-cup, Vee, or ring type;
- ***Rod Packings***—self-adjusting U-cups for air, Vee-type for oil;
- ***Rod Scraper***—cleans piston and protects rod, packing and bearing;
- ***Mounts***—interchangeable, ductile iron or steel—easily installed without disassembling the cylinder;
- ***Ports*** can be oriented to facilitate piping;
- ***All Cylinders*** tested at operating pressures before shipment;
- ***Cylinder*** easily disassembled, inspected, serviced, and re-assembled.

Available in a full range of sizes (1½" to 8" bores) with standard, 2 to 1, or oversize rods with male or female rod end, and length of stroke to meet your requirements. Completely interchangeable parts.

Write TODAY for FREE catalog showing cylinders and complete line of mounting brackets.

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Address_____
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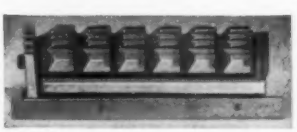
My division will actually machine parts for you. Not just a single sample, but enough production runs to provide a true evaluation of what Elox Electrical Discharge Machine tools can do in your plant. Tungsten Carbide tipped single point tools, forging dies, die casting dies and Tungsten Carbide form tools will be machined at a cost we guarantee impossible to duplicate except with Elox E.D.M. I've been able to prove to hundreds of alert concerns that these jobs can be done better, faster and less expensively with Elox than by any other method.

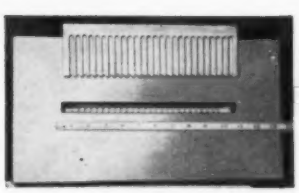
WE SAVED 19 MINUTES

grinding this single point tungsten carbide tip boring tool.



WE SAVED 16 HOURS

plus 9 different operations on this form grinding of a carbide broach.



WE SAVED 379 HOURS

on the machining of this die casting die.

WHATEVER IT'S COSTING YOU NOW... CHECK WITH ELOX

elox corporation of michigan

1837 Stephenson Hwy.
Royal Oak 3, Mich.

*T.M. Reg.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-320

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September 1956 Issue

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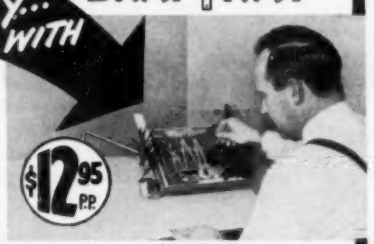

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